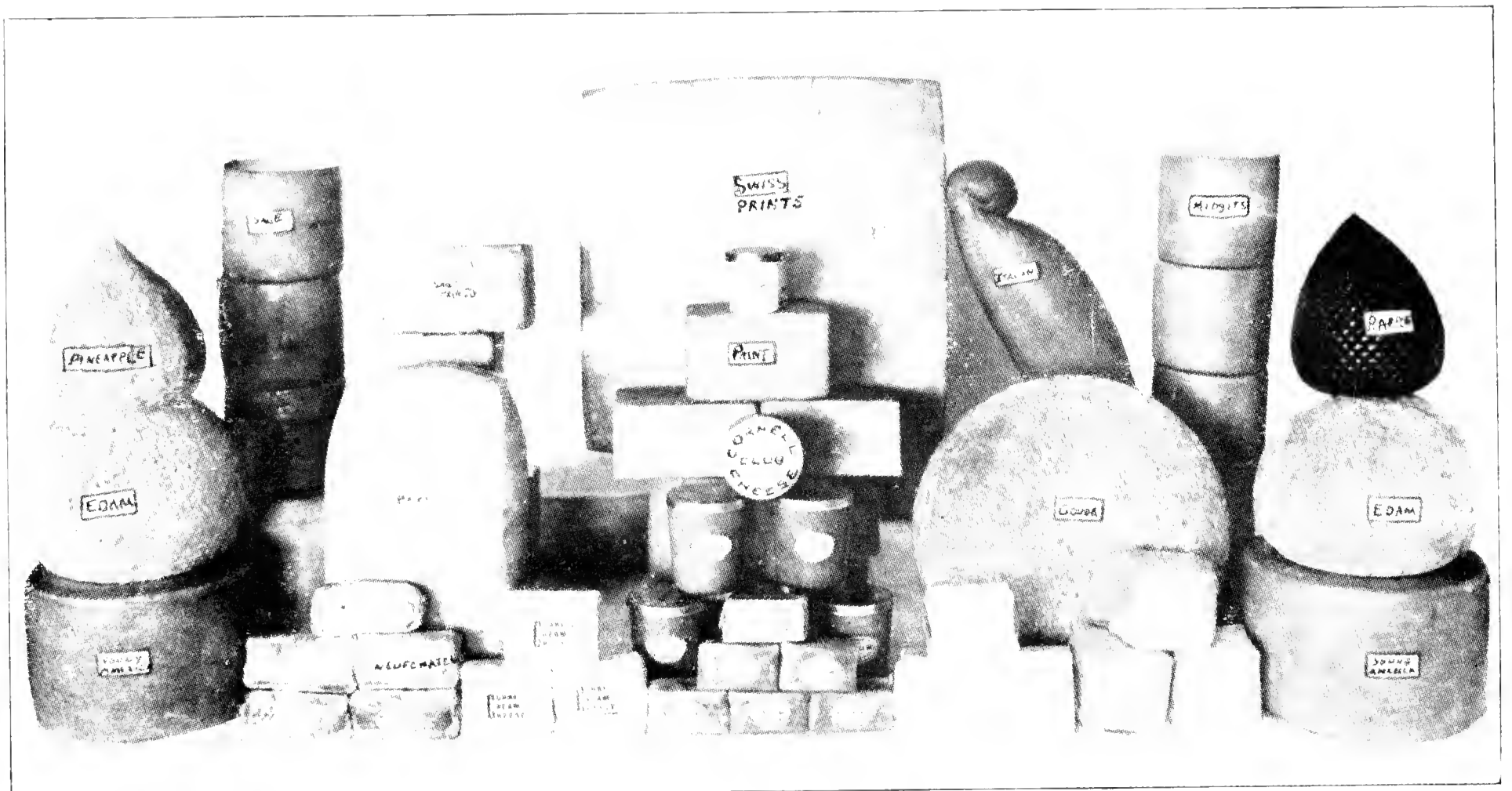
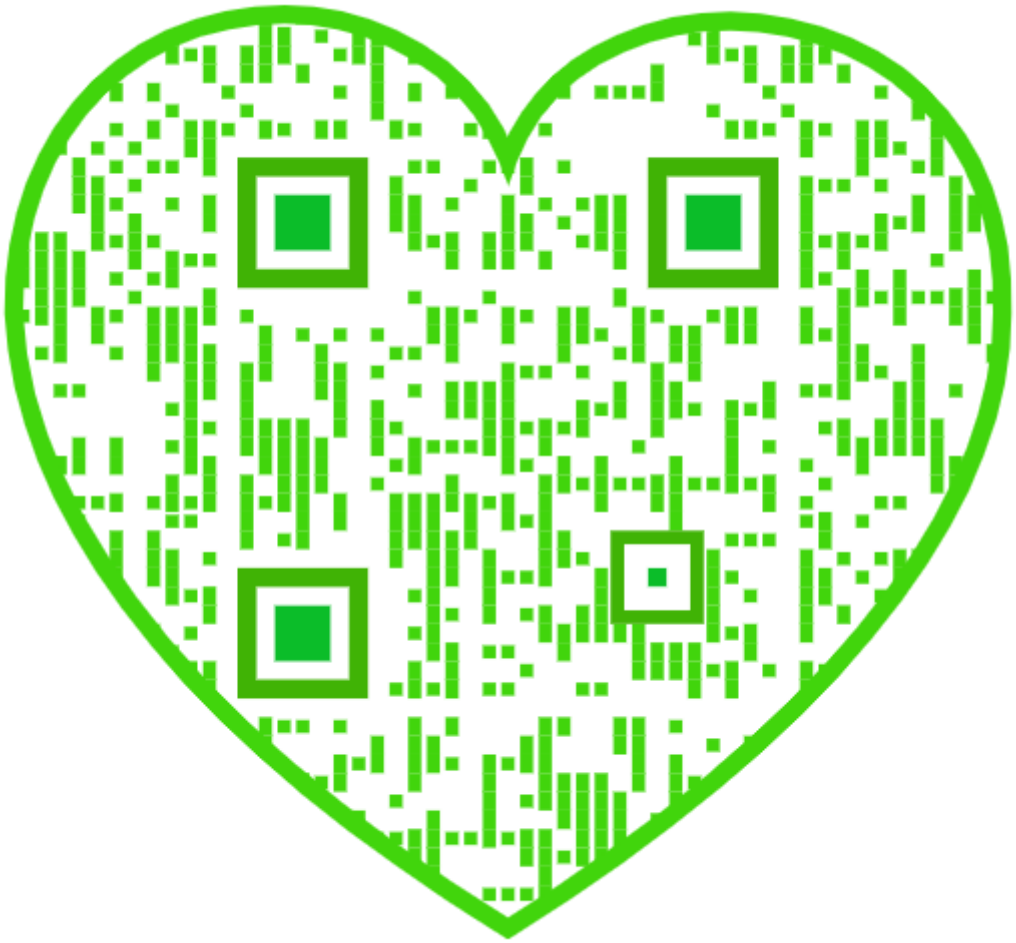


A Few of the Varieties of Cheese Made at the New York State College of Agriculture at Cornell University.



FANCY CHEESE IN AMERICA

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FROM THE MILK OF COWS, SHEEP AND GOATS

BY

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DEDICATION

This little book is affectionately dedicated to my friend and predecessor, W. W. Hall, for many years instructor in cheesemaking at Cornell University, as a slight token of appreciation and admiration for his untiring efforts in building up this department of the college, in assisting young men to success, and in building up the cheese industry of the Empire state.

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PREFACE.

The making of fancy varieties of cheese is now one of the most profitable branches of the great dairy industry. Millions of pounds of fancy or soft cheese are imported annually from foreign countries, largely because the supply of home-made goods is not sufficient to meet the demands. This is not because just as good cheeses cannot be made in this country. They can be, and in many instances the home-made cheese are better. The main reason is that factorymen in America, as a rule, do not know how to make these fancy cheeses and have had no way of learning. Those who know anything about the methods employed have kept them secret and the information contained in dairy books has been too indefinite or incorrect to be useful.

In order to make any educational progress along this line, it has been necessary for us to work out most of the problems for ourselves, and in our investigations and experimental work nothing has proved as useful as the acid test. By its use we are able to measure and control the greatest factor in the making of all cheese. Without its use the business consists only of guess work. In all our directions, therefore,

we give the amounts of acidity required, in the form of percentages as measured with an acid test. Any person can use one of these simple tests and the different manufacturing processes are made easy by its use.

Attention is called to the importance of pasteurizing all milk used in making many forms of the soft cheese. In factory work it is practically impossible to secure a regular supply of milk of reliable quality, but by pasteurization we can secure a bacteria free, uniform raw material. Then by the use of commercial cultures of lactic acid bacteria as starters, we can secure uniformly fine quality in the finished cheese, and all danger of transmission of disease through cheese or whey is eliminated. The author has also demonstrated that it is possible to make fine cheddar cheese from pasteurized milk, the particulars being given farther on in the book.

Practically all varieties can be made from the milk of cows, sheep and goats. The composition of these milks is so similar as to require little or no change in the manufacturing processes. Goat's milk is especially valuable for nearly all varieties as well as for some special varieties, such as are made in foreign countries.

In all descriptions of the manufacturing processes an effort has been made to state clear-

ly each step so that inexperienced persons may readily succeed in obtaining satisfactory results. All directions do not agree with foreign recipes, but represent facts which have proved most useful to the author in actual practice, and are here assembled in book form, with the hope that they may prove of equal value to those interested in the manufacture of fancy cheese, or as a text-book for students in agricultural colleges and dairy schools.

CHAS. A. PUBLOW.

June 1st, 1910.

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Fancy Cheese in America.

MILK COMPOSITION.

For the convenience of persons who are interested in the handling of cow's and goat's milk, the following comparative figures of average composition are given:

	Cow's milk.	Goat's milk.	Human milk.
Water	87.00%	86.50%	87.41%
Fat	4.00%	4.50%	3.78%
Casein	2.60%	3.25%	1.85%
Albumin	.70%	.82%	.44%
Sugar	5.00%	4.20%	6.21%
Ash	.70%	.73%	.31%
	100.00%	100.00%	100.00%

In the making of all varieties of cheese, pure, clean, sweet milk is the greatest requirement. Without this, the cheesemaker's art is very limited, but with it, both quantity and quality in the finished cheese are assured. For methods to be employed in securing a clean milk supply, the reader is referred elsewhere, as space will not permit of even so important a subject in this treatise. No cheese book would be complete, however, without some reference to the preparation and use of commercial cul-

tures of lactic acid bacteria as starters. Before starting the actual technique of cheesemaking, the question of starters and their use should be familiar to all persons.

Commercial Starters.

These are cultures of lactic acid producing bacteria which are prepared by bacteriologists and sold in a commercial way, accompanied by directions for their use. In their preparation for use in cheesemaking, a small quantity of milk (1 to 3 quarts) is heated to the boiling point for several minutes. This treatment destroys all living bacteria. The milk is then cooled to a temperature of 90° Fah. and the culture of lactic acid bacteria added. The temperature is then allowed to drop gradually to 70° Fah., where it is held for 24 hours, or until the milk becomes sour and thickened. A larger quantity of milk is then pasteurized to at least 165° Fah. for 30 minutes and cooled to 70° Fah., when the prepared sour milk is added. By a continuance of this procedure a pure, clean, reliable and uniform starter is available each day, the intelligent use of which will do much in determining quality in the cheese.

Cheddar Cheese.

Cheddar cheese derives its name from the village of Cheddar in England and is the variety of cheese made in largest quantity in Canada

and the United States, as well as in some other countries. It is a cheese of firm body, smooth texture, characteristic flavor and possessing long-keeping qualities. It is usually marketed in a number of sizes, which are recognized in the markets as follows: A large cheese, about 15 inches in diameter, weighing about 80 lbs., constitutes an "export"; one of similar diameter, weighing about 35 lbs., "a flat," or if shipped two in a box, "twins"; a 20-lb. size, "daisies"; 8 to 10-lb. size, "young Americas" and a 2-lb. size, "midgets."

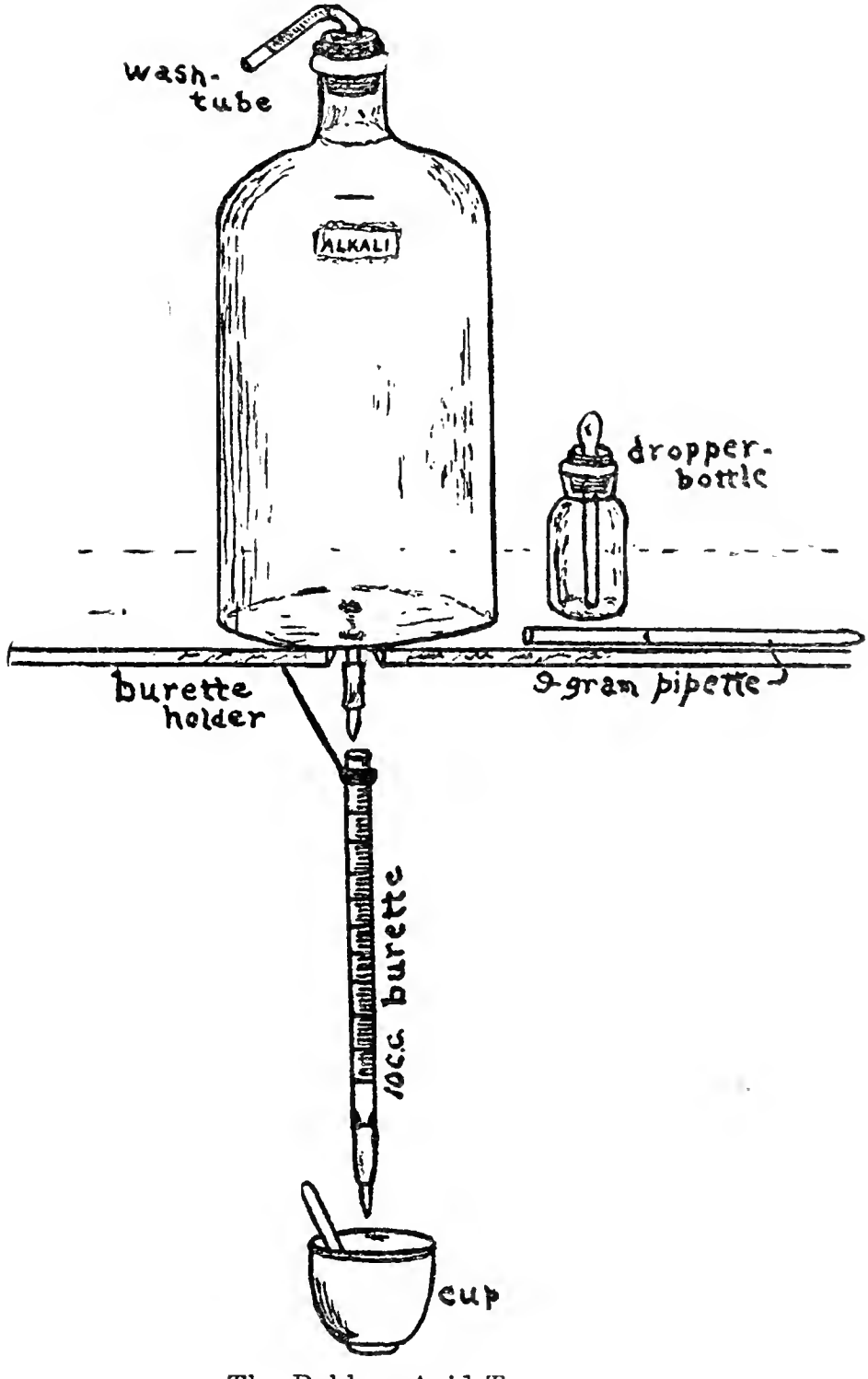
Method of Manufacture for Home-trade Cheddars.

Milk is heated to 86° Fah. and ripened by the use of a commercial starter or naturally, until it reaches about .20% acidity. Usually ½% to 2% of a starter is sufficient to ripen milk. If colored cheese are desired, cheese color at the rate of 1 oz. per 1,000 lbs. of milk is added and stirred evenly through the entire mass. About 3 oz. of rennet extract diluted in 20 times its weight of cold water is then added and 4 or 5 minutes should be taken in stirring it in. In 8 or 10 minutes after adding the rennet, the milk will commence to thicken, but should not be disturbed for 25 or 30 minutes, or until it has become a firm, solid mass that will split clean ahead of the finger. When it has reached this

state it should be cut into small cubes, using first a ⅜-in. horizontal knife lengthwise of the vat, then a 5/16-inch perpendicular knife crosswise and finally lengthwise of the vat.

The curd and whey will then begin to separate and should be stirred gently with a wooden rake or similar instrument to keep the particles from lumping. In a few minutes, or as soon as the whey surrounding the curd shows an acidity of .14%, the temperature should be raised gradually (25 to 30 minutes) to 98° Fah., at which temperature it is held until the particles become firm and springy, and the whey has increased in acidity to .18%. Then the whey should be removed rapidly, so that by the time it is all off and the curd stirred sufficiently dry, the whey running from the curd, which is piled about 8 inches deep along the sides of the vat, will show not more than .26% acid. The operations from the time of adding the rennet till the whey is off requires at least 2 hours' time.

In 15 minutes, or as soon as the curd has become firmly matted, it should be cut into strips 6 inches wide and turned over. This allows all free whey to escape. The curd should then be turned every 15 minutes until it becomes meaty in texture and the whey running from it shows .65% acid. It is then ready for milling and should be cut into pieces of uniform



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size. After a few minutes' stirring, salt is applied at the rate of about 2 lbs. for each 100 lbs. curd. At least three divisions of the salt are necessary for an even distribution.

As soon as the curd has become mellow after salting, it should be placed in cheese hoops and pressed. In about one hour they can be removed from the press and the bandage pulled up and trimmed. They should then be put back in the press and left for 18 to 24 hrs., when they should be wiped dry and placed on shelves in the curing room and kept at a temperature as near 55° Fah. as possible. When 4 or 5 days old they should be dipped for 8 to 10 seconds in hot paraffin at 220° Fah. A coating of paraffin prevents shrinkage and keeps the cheese surfaces clean. Cheese should be turned on the shelves daily while ripening and should not be offered to consumers until at least one month old. (For a detailed study of cheddar cheesemaking, consult "Science and Practice of Cheesemaking," published by Orange Judd Co., New York City.

Composition of Cheddar Cheese.

Fat	32.00
Casein	26.00
Water	37.00
Sugar, ash, salt, etc.	5.00
	100.00

Stirred Curd Cheese.

This is a variety of cheddar cheese, different only in the details of manufacture. The regular cheddar method is followed up to the time of removing the whey. Then instead of allowing the curd to mat into a solid mass, it is stirred sufficiently to keep the small particles separated until firm and rather dry. Salt is then added and the cheese finished in the usual way. This is sometimes called the granular method and was used almost entirely before the days of the curd-mill.

Washed Curd Cheese.

This is another variety of cheddar cheese that has met with favor on certain markets in recent years. The cheese are made by the regular cheddar method up to the time of milling the curd, when the curd is immersed in cold water for several minutes before salt is added. About the only advantage in adding the water is to cause the cheese to soften at an early date. If the curd is left in the water five minutes or longer it will increase in weight by absorbing water. The colder the water the more rapidly it is absorbed. At the same time some of the lactic acid, sugar, fat, rennet and salts are removed, with the result that the cheese develop little or no flavor unless they have been soaked in the water too long, when the cheese will spoil

and smell badly in a short time. The cheese spoil owing to the absence of the natural ripening agents, which have been removed in the water. Abnormal changes then occur through the work of undesirable forms of bacteria.

The best washed curd cheese are made from the best cheddar curds, which are immersed in pure water at 60° F. for not more than 2 to 5 minutes.

Skimmed Milk Cheddar Cheese.

During recent years, in some states, there has been a marked increase in the number of cheddar cheese made from skimmed milk. The manufacture of such imitation products has been stimulated by the comparatively high prices paid by buyers, as compared with the market prices of full milk cheddars. Probably this condition is backed up by the fact that cheesemakers are able to remove part of the fat from the milk and replace it with moisture in the cheese, with such skill that the consumer believes he is eating a rich, mellow cheese, when in reality it may have been made from only 2% skimmed milk.

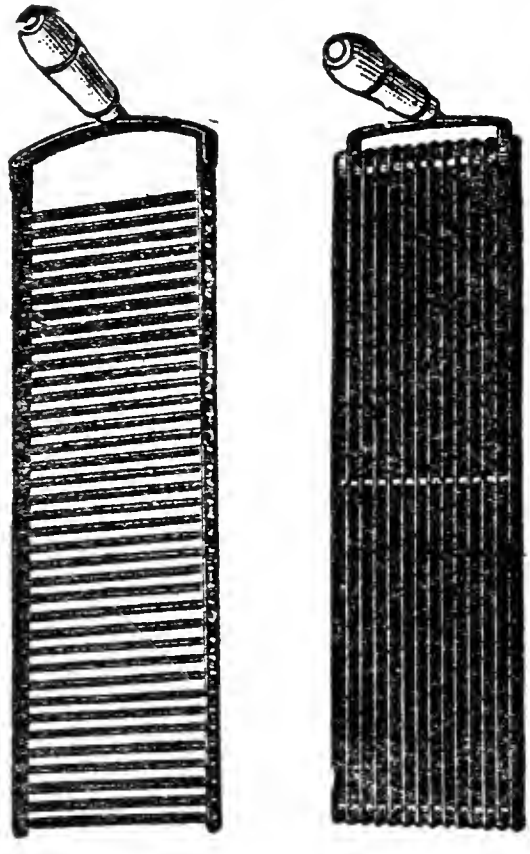
The method of manufacture to follow in making such cheese must vary according to the amount of fat in the milk. The less fat present, the more difficult it is to secure cheese of passable quality. The great variation in the fat

content of skimmed or partly skimmed milk makes it impossible for one to give accurate directions to be followed as an unmodified rule. We, however, are safe in giving the directions for making up to 2% milk and in making up separator skimmed milk. The maker can then vary the details as he varies the composition of the milk.

Cheese from 2% Skimmed Milk.

Milk should be heated to 84° F. and ripened by some good commercial starter or clean flavored buttermilk, until it shows an acidity of 22%. (It is seldom advisable to use more than 2 pounds of starter to each 100 pounds of milk.) If colored cheese is desired, cheese color is added at this time. Usually one-half ounce to 1,000 pounds milk is sufficient. Enough rennet extract (3 ounces [90 c.c.] per 1,000 pounds milk) to coagulate the milk fit for cutting in 20 minutes is then added after being diluted in 20 times its volume of cold water. As soon as the milk is firmly coagulated, it should be cut into cubes about ⅜ inch square by the use of horizontal and perpendicular curd knives. The curd is then stirred gently with a wooden rake or agitator to keep the particles separated, and the temperature raised gradually to 92° F. In about 30 minutes after cutting, as soon as the curd begins to feel firm and springy, and as

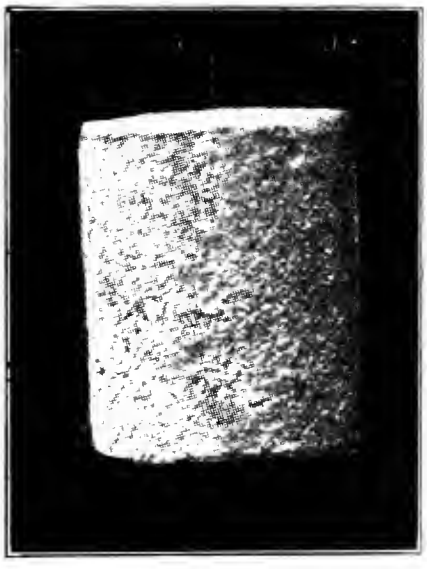
soon as the whey surrounding the curd shows an acidity of .17%, the whey should be quickly removed. While the whey is running off, the curd should be constantly stirred, in order to insure a proper expulsion of whey and a uniform color in the cheese. After the whey is



Cheddar Curd Knives.

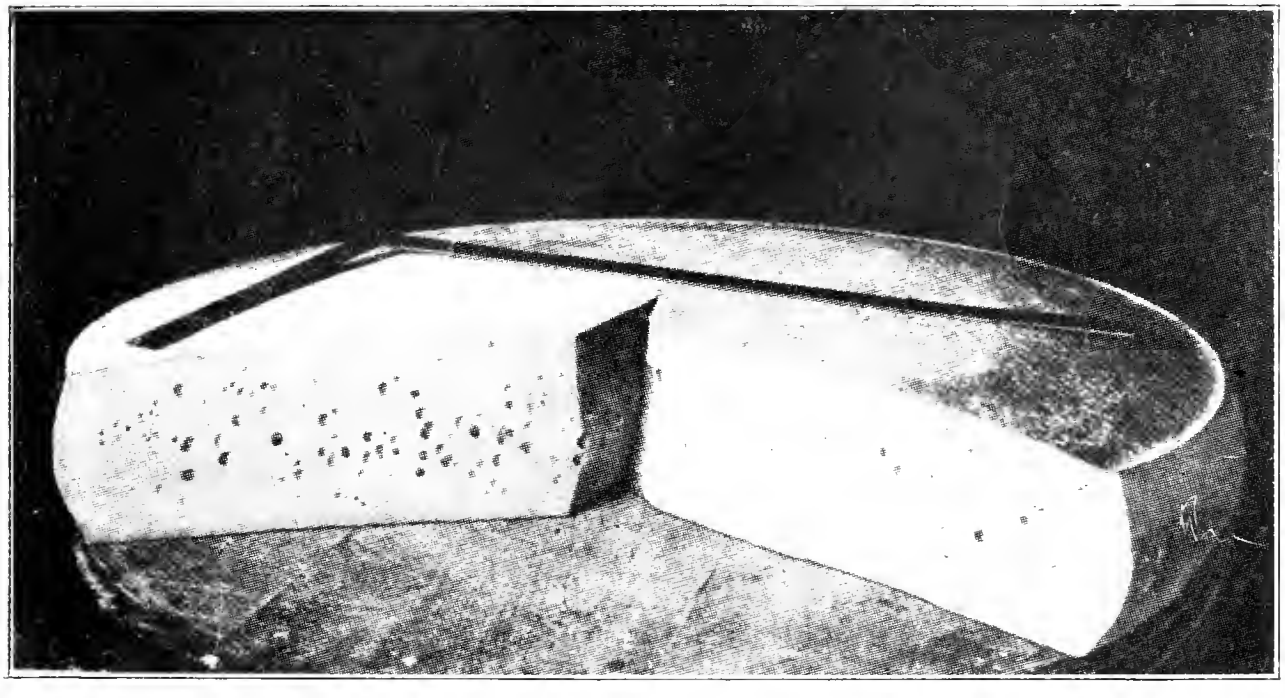
off, the curd is packed about 8 inches deep along the sides of the vat with a space in the center for drainage. The whey running from the curd at this time should contain not over .24% acid.

As soon as the particles have become firmly matted, the curd should be cut into strips 8 to 10 inches wide and turned bottom side up. In



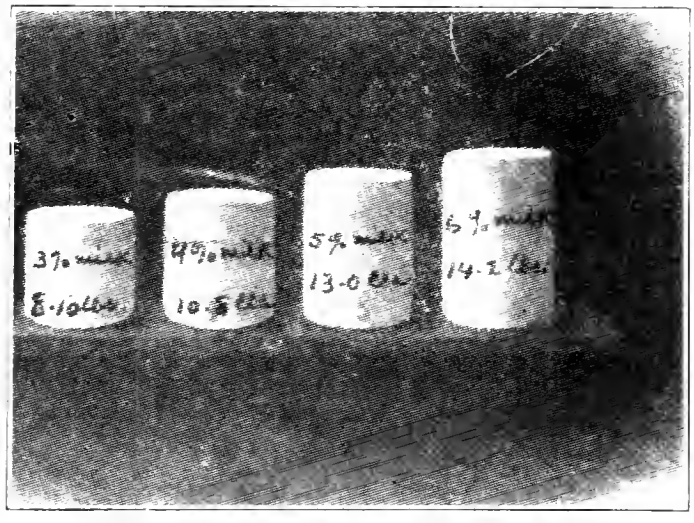
Stilton Cheese.

(See Page 37)



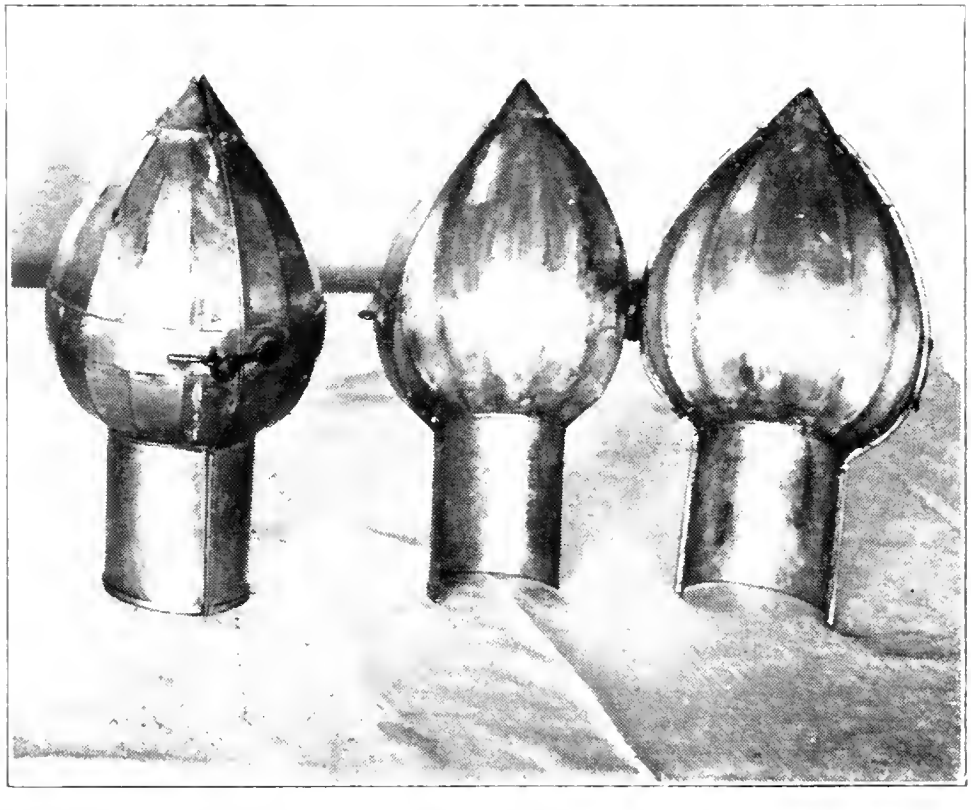
Cross-section of a drum Swiss cheese, showing location, size and glossy condition of the "eyes."

(See Page 26.)



Photograph showing amount of cheddar cheese available in 100 pounds of 3%, 4%, 5% and 6% milk.

(See Page 9.)



Style of pineapple molds used at the New York State College of Agriculture.

(See Page 22.)

15 minutes more the pieces can be piled two or three deep, and turned every 15 minutes afterward until the curd becomes meaty in grain and the whey running from it contains .65% acid. It is then milled and salted, 1½ to 2 pounds to each 100 pounds of curd. The remaining procedure is similar to the regular cheddar method. A coating of paraffin placed on skimmed milk cheese when four or five days old is specially valuable in preventing shrinkage and drying. It is possible by this method to make cheese from partly skimmed milk that are very difficult to distinguish from full milk cheese, and they usually sell within 1 to 1½ cents per pound under the market for fancy goods.

Cheddar Cheese from Separator Skimmed Milk.

By no known method is it possible to make a really fine cheese from full skimmed milk; but by replacing the fat with an excessive amount of whey or water it is possible to make cheese that can be readily sold to a certain trade, and which have sold for as high as 10 cents per pound wholesale.

The skimmed milk is heated to 84° F. and ripened to .24% acid by the addition of commercial starter or buttermilk. It is advisable to use as much starter as can be safely handled without making the cheese too acid, as commercial

starter and buttermilk both have a softening effect upon cheese texture. Usually from 5 to 6 pounds to 100 pounds of skimmed milk is sufficient. Little coloring should be used, as skimmed milk cheese are usually high enough in natural color. When the milk is ripened to the proper degree, 4 ounces of rennet per 1000 pounds milk, diluted in 20 times its weight of cold water, is added and thoroughly stirred into the milk for 3 minutes. The milk is then left undisturbed until coagulated firmly, when it is cut into cubes with the regular curd knives. After cutting, the curd is stirred gently for 5 minutes, or until the particles become "healed" over and begin to contract. The whey is then quickly removed and the curd piled, without stirring, at least 12 inches deep in the upper end of the vat, without a drain being made in the center. The whey running from the curd after packing should contain not over .22% acid. As soon as the curd becomes firmly matted (usually about 15 minutes) it is cut into large pieces and turned. In 15 minutes more it is ready for milling. After milling it should be rinsed off with pure cold water and salted 1¼ pounds to each 100 pounds of curd. In a few minutes the curd can be pressed and finished in the same manner as full milk cheese. Cheese of this nature shrink rapidly while cur-

ing, unless paraffined. The paraffin can usually be satisfactorily applied when the cheese are 3 to 4 days old. When ripened at a temperature of 70° F. these cheese become ready for consumption in about 30 days.

Cheddar Cheese from Pasteurized Milk.

It has always been considered impossible to make fine cheddar cheese from pasteurized milk. The effects of heat upon the enzymes and salts in milk are such as to materially change its nature in many ways. These changes are noted, first, when rennet is added to milk that has been pasteurized. It does not coagulate unless left for hours, because the heat has rendered the soluble calcium milk salts insoluble, thereby preventing the combined action of rennet, calcium and casein, which causes the precipitation of casein and the coagulation of the milk. When soluble calcium salts are added to pasteurized milk, rennet readily coagulates it, but the curd does not contract or firm in the whey, and after the whey has been removed the particles of curd fail to unite properly, with the result that the cheese is of a mealy, "sawdust-like" body. The writer has succeeded, however, in experiments conducted in the New York State College of Agriculture in making a uniformly fancy, long-keeping and quick-ripening cheese from milk

heated sufficiently high to kill practically all bacteria. The method is as follows:

Milk, after pasteurization to 165° F., is cooled to 90° F. Two c.c. of a 25% solution of calcium chloride is then added for each 100 pounds milk, and followed by 2 to 3% commercial lactic acid culture. Three ounces of rennet extract to each 1000 pounds of milk is then distributed through the milk. In about 5 minutes coagulation takes place, but the curd does not become firm enough for cutting in the usual time and should not be cut before it is firm. Usually about 40 minutes elapse from the time of first coagulation until the curd can be properly handled. After cutting, the method is similar to the regular cheddar process. The success of this procedure is based on getting a firm coagulation and a proper precipitation of the particles of casein, which are slow to unite after precipitation. The advantages of pasteurizing milk for cheddar cheesemaking are as follows:

1. Milk of undesirable flavor, containing gas-producing bacteria and other "not-wanted" forms, can be successfully made into good cheese.

2. A uniform raw material is available each day.

3. By the use of proper cultures of lactic

acid bacteria, a uniformly high grade cheese should be made every day.

4. Danger of transmission of disease in the cheese and whey is eliminated.

5. Milk that otherwise could not be accepted by cheesemakers can, after pasteurization, be made into good cheese.

Cheese made in this manner from pasteurized milk can be recognized by its noticeably clean, rich, mild flavor. Even after several months the flavor does not become strong. This fact is probably explained by the fact that undesirable bacteria and their products are practically eliminated by pasteurization of the milk. As investigations and experiments are continued we may expect that more light may be thrown on the causes of cheese ripening and cheese flavors, but from a practical standpoint, it is now certain that cheddar cheese can be successfully made on a commercial basis from pasteurized milk.

Sage Cheese.

Sage cheese is another modified form of the cheddar variety. Its distinguishing features are a mottled green color and a sage flavor. The usual method of manufacture is as follows: One-third of the total amount of milk is placed in a vat by itself and colored green by the addition of 8 to 12 ounces of commercial sage color to each 1,000 pounds of milk. If green corn leaves

or other substances are used for coloring the amounts will vary accordingly. The milk is then made up by the regular cheddar method, as is also the remaining two-thirds, in a separate vat. At the time of removing the whey the green and white curds are mixed. Some prefer, however, to mix the curds at the time of milling, as a more distinct color is secured. After milling, the sage extract flavoring is sprayed over the curd with an atomizer. The curd is then salted and pressed into the regular cheddar shapes and sizes.

A very satisfactory sage cheese is made at the New York State College of Agriculture by simply dropping green coloring, made from the leaves of corn and spinach, upon the curd, after milling. An even green mottling is thus easily secured without additional labor. Sage flavoring extract is sprayed over the curd by an atomizer. One-half ounce of flavoring is usually sufficient for 100 pounds of curd and can be secured from dairy supply houses.

Pineapple Cheese.

Pineapple cheese is so called because of its appearance, resembling the shape of a pineapple. These cheese were first made in the State of Connecticut, but are now made by a number of concerns in New York State and a few others. The market for pineapple cheese is very limited,

owing to the high prices for which they must sell in order to repay the manufacturers for the large amount of work required in manufacturing and ripening the cheese.

Methods of Manufacture.

The milk is placed in a regular cheddar cheese vat and heated to 88° F. A small amount of commercial starter (¼% to ½%) is then added and the milk ripened to .20% acid. Three ounces of cheese color is mixed thoroughly in every 1,000 pounds of milk and when the proper degree of acidity is reached, rennet extract, diluted in 20 times its weight of cold water, is added at the rate of 2½ ounces to each 1,000 pounds of milk. In 25 or 30 minutes the milk should be firmly coagulated and fit for cutting, which is similar to the method of cutting in making cheddar cheese. After cutting the curd is stirred gently by hand or with a wooden rake for 10 minutes, or until the cubes of curd become "healed" over and commence to contract. The temperature is then raised gradually (25 to 35 minutes) to 115° F., or even 120° F., where it is held until the curd becomes very firm and the acidity of the whey reaches .18%. The whey is then removed and the curd placed in the hoops or molds. When the molds are half filled, a small amount of salt is added and then the balance of the curd is put in. Pressure is

applied to the hoops until the cheese assume their required shape, when they are taken out and dipped in warm whey or warm water at a temperature of 120° to 125° F. for 2 or 3 minutes. They are then placed in individual nets and hung up until the diamond-shaped spaces of the netting become permanently impressed in the cheese surface, when they are removed, rubbed with salt and placed in the curing room, which should be held at a temperature close to 65° F. The cheese being very firm require 4 to 6 months to ripen and during this time are frequently rubbed with boiled linseed oil, which makes the surface smooth and hard. One hundred pounds of 4% milk yields 6 to 7 pounds of pineapple cheese, which retails for as much as 60 cents per pound.

Composition of Pineapple Cheese.

Water	12.00%
Fat	44.00%
Casein	38.00%
Ash, salt, acid, etc.	6.00%
	100.00%

Brick Cheese.

Brick cheese is purely an American product and receives its name from its resemblance in shape to the common brick. In quality, this cheese is somewhat similar to Limburg, but is

firmer and more rubbery, and the round, shiny holes, which form while the cheese is ripening, are not unlike those of Swiss or Emmental cheese.

Method of Manufacture.

Clean, sweet milk is heated to 86° F. The acidity of the milk should not be over .16%. For this reason, little or no starter is added, but the milk is set, in the vat, immediately after its arrival at the factory, 2½ to 3 ounces of rennet diluted in cold water being used for each 1,000 pounds of milk. In 25 to 35 minutes, or as soon as the curd is firm, it is cut into small cubes with the regular cheddar curd knives and stirred carefully for 10 minutes, when the temperature is gradually (20 to 25 minutes) raised to 110° F. to 115° F. The curd is constantly stirred with a wooden rake until it becomes firm and springy, when it is dipped into the brick-shaped molds. The acidity of the whey at this time should not be over —.14%. The molds, which are bottomless and measure 10x6x6 inches, are placed on a draining table. As soon as they have been filled with curd they are covered by cotton cloth, a wooden or metal follower is put on and 1 or 2 bricks are used on each cheese for pressure. During the following 18 hours the molds are occasionally turned and as soon as the cheese are properly pressed

they are taken out and rubbed all over with salt. The salting is repeated each day for 3 days, and during the interval the cheese are piled 3 or 4 high. Brick cheese ripen rather slowly and require a temperature of 65° F. to 68° F., as well as a moist atmosphere. During the ripening, which requires at least 2 months, the cheese are occasionally rubbed by hand and moistened with water to keep the surfaces free from cracks and the growth of mold. When ready for market these cheese have a pronounced, sweet flavor, an open body filled with round, glossy holes, and retail for 20 to 25 cents per pound.

Composition of Brick Cheese.

Water	32.00%
Fat	36.00%
Casein	28.00%
Ash, salt, acid, etc.	4.00%
	100.00%

Swiss, Switzer or Emmenthaler Cheese.

All these names are applied to a type of cheese that is very popular in almost all countries of the world. Originally it was made in the canton of Emmental, Switzerland, where it is known only as Emmental cheese. In America, where it is made in large quantities, it is better known under the names of Swiss and Switzer.

Swiss cheese is very similar to Cheddar cheese, but has a more salty taste and the body is made porous by the presence of large, round, glossy holes or "eyes." They are made in several sizes, the two most common being the "block," which measures 6 inches square, 20 inches long, and weighs 25 to 30 pounds; and the "drum," which measures 36 inches in diameter, 5 to 6 inches in thickness and weighs 175 to 200 pounds.

Methods of Manufacture.

The foreign method of manufacture is slightly different from the American, especially in the apparatus used, but the style and quality of the cheese are in no way different. Clean, sweet milk is placed in a copper kettle or cheese vat, heated to 90° F. and ripened by the addition of a small amount (not over ¼%) of lactic acid culture to an acidity of .165% to .170%. Rennet extract diluted in cold water is then added at the rate of 3 ounces per 1,000 pounds of milk, and after a thorough mixing by 3 minutes of stirring, the milk is left undisturbed until it is firmly coagulated, when it is cut into small cubes. When the milk is in copper kettles the curd is usually cut with a "harp" (an instrument very similar to a perpendicular wire cheddar curd knife, with a long handle and wires 1 inch apart) into pieces 1 inch in diameter, and

then stirred with a wire basket fastened to the end of a stick 5 or 6 feet long. The stirring breaks the curd into small pieces about the size of those required in making cheddar cheese. Cutting and breaking the curd in this manner causes a large loss of fat in the whey, and the pieces are not uniform in size. By using the 5/16-inch cheddar curd knives instead of the harp and basket, the curd can be cut into pieces of uniform size, a uniform expulsion of whey can be secured and the fat loss can be reduced over 50%. After a few minutes' stirring, heat is applied to the vat of kettle and the temperature raised in 20 to 25 minutes to 135° F. to 140° F. The stirring is continued until the curd is very firm and rubbery, when it is allowed to settle to the bottom. The acidity of the whey at this time should be .14% to .145%. The temperature by this time will probably have cooled to 110° F. or 115° F. As soon as the curd is firm enough and of the proper acidity (.15% to .16%) the curd is removed from the whey and placed in the forms or hoops, which are lined with cotton. Pressure is then applied, rather lightly for the first 30 minutes, then heavy and continuous for 24 hours. During this time the presses should be loosened up, the cheese taken from the hoops, all rough edges trimmed off and the bandage cloth made free from wrinkles.

This operation may have to be repeated 2 or 3 times during the day and when the cloths are re-applied they are first dipped in hot water to assist in producing a good rind on the cheese.

When sufficiently pressed, the cheese are taken from the hoops and placed in a strong salt solution for 3 days, or salt may be rubbed on the surfaces. When brine salting is used, the brine should be concentrated enough to float an egg. The cheese will also float and should be turned each day, so that all parts may absorb the same amount of salt. When dry salting is practiced, the cheese are placed in salting molds and as much salt as will be absorbed during the night is sprinkled over the top. Dry salt is applied in this manner on 4 or 5 consecutive days. Brine salting is more satisfactory as there is a more even distribution of salt in the cheese, a more uniform development of gas and a better formation of the "eyes."

When taken from the brine tank, the cheese are placed in a room where the temperature is kept at 70° F. and the moisture at 80%. Here the cheese remain for at least 7 days, or until the "eyes" have formed. This point can be determined by tapping the top of the cheese with the fingers. If the eyes are present a hollow sound is produced. They are then placed in a cooler cellar, when the temperature is retained

at 60° F. and the moisture at 80%. Here the cheese remain for several weeks until properly ripened, and during this time should be turned at least twice a week on the shelves. The yield of Swiss cheese is about 10 pounds from 100 pounds of milk.

Defects in Swiss Cheese.

All the common defects found in Cheddar cheese are found in Swiss cheese, and for the causes and remedies of these the reader is referred to "Science and Practice of Cheesemaking," published by Orange Judd Co., of New York. In addition to these, however, we have the special defects in the texture of Swiss cheese, most important of which is the improper formation of the "eyes." A cheese without "eyes" is said to be "blind"; one with small pin-holes is called a "niszler"; one with flat, narrow slits is called a "glaesler." These defects are easily prevented by paying strict attention to the acidity and cleanliness of the milk and starter, to the temperature of the curd and the curing rooms, and to the even distribution of the salt. Salt, low temperature and dry air all tend to check the formation of "eyes." High temperature and excessive moisture causes a too rapid formation of gas, a poor quality of eyes and undesirable flavors.

Composition of Swiss Cheese.

Fat	33.00%
Casein	24.00%
Water	38.00%
Ash, salt, acid, etc.	5.00%
	100.00%

Edam Cheese.

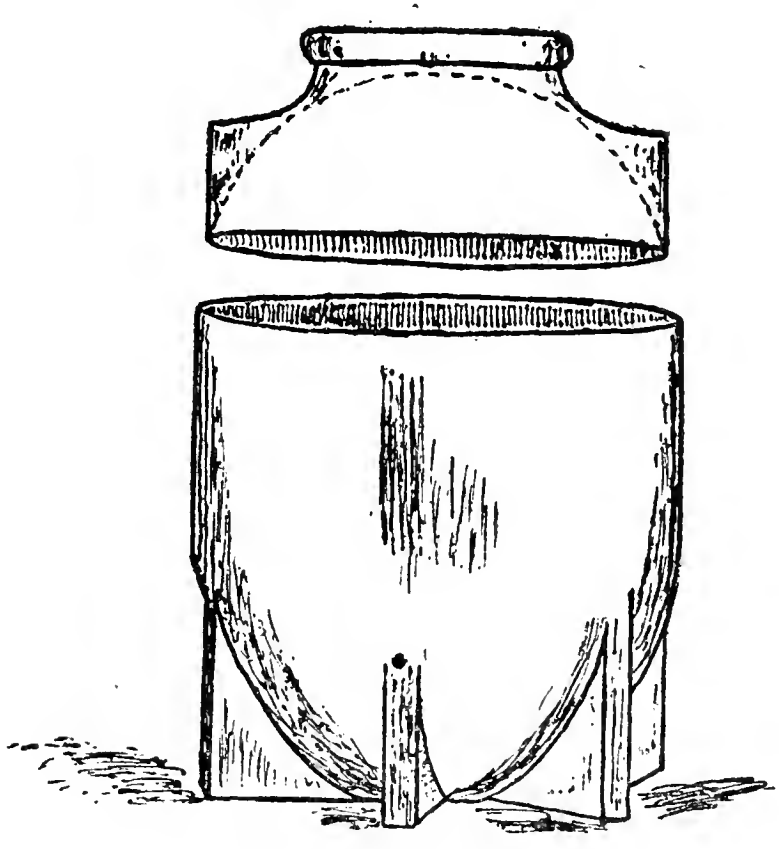
Edam cheese receives its name from the place, Edam, in Holland, where most of the cheese of that country are first marketed. A large quantity is imported to America annually, and are easily recognized by their round, ball shape and red color. Edam cheese can be made equally well in America as in Holland, and when we consider the high prices for which they sell, it seems strange that American manufacturers do not include this variety in their regular output.

Method of Manufacture.

Edam cheese was originally made from unadulterated cow's milk, but most of it is now made from milk which has had at least one-half of its fat removed. The milk should be perfectly fresh and is heated in a cheese vat to 90° F., when cheese color is added, 1½ to 2 ounces per 1,000 pounds of milk. As soon as the color has been thoroughly distributed, enough rennet extract (5 ounces per 1,000 pounds of milk) to coagulate the milk fit for cutting in 15 minutes,

is diluted in 20 times its weight of cold water and mixed quickly and thoroughly with the milk. Coagulation commences in 4 or 5 minutes, but the curd should not be disturbed until it is firm and splits cleanly ahead of the finger, when it is cut in a similar manner as in cheddar cheese-making. After cutting the curd is stirred carefully for 15 minutes, during which time the temperature is raised to 95° F. The curd by this time will have begun to contract and firm, so the whey should be allowed to run off until the upper surface of the curd appears. The curd and remaining whey is now dipped into the press molds, which should be lined with cheese cloth to insure a smooth surface on the cheese. When the press molds are filled the covers are put on and pressure of 25 to 30 pounds applied steadily for 30 minutes or until the cheese assume their form. They are then taken from the molds, dipped for 2 minutes in hot whey at 125° F., freed from rough edges, covered evenly with strips of cheese cloth and returned to the press molds, where they are left, under light but steady pressure, for 10 to 12 hours. Edam cheese molds are frequently made of wood, but galvanized iron is much better, as it does not expand and contract like wood, or require so much attention to keep it in a sanitary condition.

When the cheese are sufficiently pressed they are taken from the press molds, rubbed with salt and placed in the salting molds, where they remain for 5 or 6 days, being rubbed each day with salt and the ends reversed in the molds in order to prevent irregular shaping of the ends.



Edam Cheese Mold.

Sometimes the cheese are salted by being immersed in a strong brine for several days, but dry salting gives better results and the surfaces do not crack so readily. After the cheese have been in the salting molds 5 or 6 days they are taken out, washed with hot whey, dried with a cloth and placed in a moist curing room with a

humidity of 80% and a temperature of 60° F. Here they are turned daily for the first week and then twice a week until 4 or 5 weeks old, when they are washed with water at 70° F., placed in the sun to dry and rubbed with boiled linseed oil. The oil makes the surface smooth and hard and helps to prevent cracking. By the time the cheese are 6 to 8 weeks old they are colored red by being immersed for a few minutes in an alcoholic solution of carmine or Berlin red. As soon as they are dry, they are again rubbed with linseed oil, wrapped neatly in tinfoil and packed, 12 in a box, for shipment. Occasionally they are exported in sealed, air-tight tin cans.

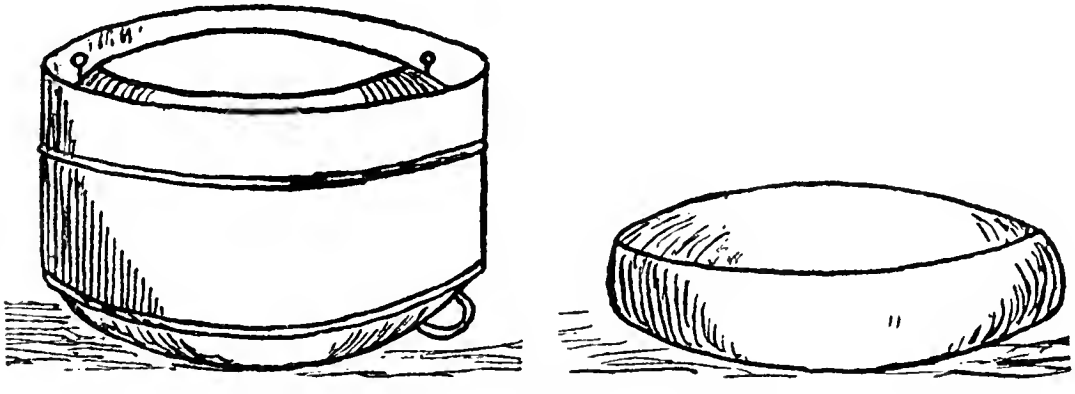
Edam cheese, when ready for market, weigh 3½ to 4 pounds, and usually retail for at least 30 cents per pound. When cut, the flavor is seen to be mild, the taste somewhat salt, the body dry, firm or crumbly and the texture almost entirely free from holes.

Composition of Edam Cheese.

Fat	29.00
Casein	35.00
Water	30.00
Ash salt, acids, etc	6.00
	100.00

Gouda Cheese.

This is another variety of cheese that receives its name from that of a town in Holland. In shape they resemble one of our small "Daisy" cheese that has swelled or "puffed up" at both ends. They are made in several sizes, ranging from 8 to 45 pounds. A considerable quantity is imported to America annually, especially of the 10-pound size, which come



Gouda Press Mold and Cheese.

wrapped in a bladder or animal membrane. Gouda cheese can be made equally well in America as in Holland.

Method of Manufacture.

Fresh, clean milk is placed in a cheese vat, heated to 90° F., and colored at the rate of 1 ounce of annatto to 1,000 pounds of milk. Enough rennet extract (5 ounces per 1,000 pounds of milk) to give a firm coagulation in 15 minutes is then added, and as soon as the curd will split cleanly ahead of the finger it is

cut into small pieces by the use of the smallest meshed cheddar curd knives. After cutting, as in the cheddar method, an additional cut is made by running the horizontal knife lengthwise of the vat. The curd is then stirred carefully and the temperature raised in 30 minutes to 104° or 106° F. In 30 to 45 minutes the curd should be very firm, like rubber, and make a squeaking sound when squeezed in the hand or pressed between the teeth. At this time the whey should have .115% to .12% acid.

The whey is then taken off and the curd placed in the molds, which are first lined with cheesecloth. The cheese are then put under a pressure of 50 to 100 pounds for 30 minutes, when they will have assumed their form. They are now removed from the molds, trimmed free of rough edges, neatly wrapped with cheesecloth and returned to the molds under light but steady pressure for at least 12 hours. When sufficiently pressed, the cheese are again removed from the molds and rubbed with dry salt each day for 10 days. At the end of 10 days they are thoroughly washed in water at 120° F., dried with clean cloths and placed on shelves in the curing room, where they are turned every 2 or 3 days until ready for market. The curing room air should have at least 80% moisture and be kept at a temperature as near 60° F. as pos-

sible. If the room is too moist or too warm the surface of the cheese may become moldy or covered with slime. If such does occur, the cheese should be again washed with water at 90° F. and wiped dry.

Gouda cheese are seldom fit for consumption before they are 4 or 5 months old, and before being placed on the market the outside is colored by dipping in a solution of saffron. About 10 pounds of Gouda cheese is available from 100 pounds of average cow's milk, and the retail price is usually above 25 cents a pound.

Composition of Gouda Cheese.

Fat	35%
Casein	24%
Water	36%
Ash, salt, acid, etc.	5%
	100%

Stilton Cheese.

Stilton cheese is said to have originated in Leicestershire county, England, and to this day its manufacture is confined almost entirely to England. A large quantity of Stilton is imported to America annually, where it is held in high favor. In size, Stilton cheese resemble our "Young American" cheddars, weigh about 12 pounds each, and when marketed have a coating of blue mold and a very wrinkled surface.

Method of Manufacture.

In making the best Stilton cheese, two separately made curds are used. This is done with the idea of getting more air-spaces in the body of the cheese, as two separately made curds do not unite as readily as curd from the same vat.

Clean, fresh, morning's milk is placed in a cheese vat and heated to 84° F. Rennet extract at the rate of 1 ounce to 1,000 pounds of milk is then added in cold water and stirred thoroughly throughout the entire mass. In 60 to 90 minutes the milk should be firmly coagulated, as in making cheddar cheese. When it has reached this condition it is cut lengthwise of the vat with a horizontal curd knife and immediately ladled out of the vat into straining cloths placed in a curd sink. Each cloth is about 36 inches square and holds about 30 pounds. As soon as all the cloths are filled, they are tightened around the curd by bringing together the three corners and using the fourth as a binder. They are then packed closely together in the curd sink and the corners tightened every hour for 8 hours. In the evening the curd is cut into squares about 4 inches square and laid in the draining sink, with a light cotton cloth over it, where it remains till the following morning.

The evening's milk is treated in the same manner as the morning's milk, being allowed to

drain during the night, while in the curd sink. In the morning the evening's curd is cut into pieces 4 inches square. As soon as the morning's curd has an acidity of .65% and the evening's curd an acidity of .45% the two curds are milled or broken up by hand and salted at the rate of 1½ pounds to 100 pounds curd. In 10 minutes, or as soon as the salt dissolves, the curd is put in the hoops, which are lined with cheese cloth, similar to cheddar hoops. Sometimes molded bread crumbs are distributed over the curd at the time of salting. In filling the hoops the curd should be packed firmly in the center but left rather loose at the outside.

No pressure is used in making Stilton cheese. The hoops are placed on draining boards or shelves, turned or inverted two or three times during the day, and once each day for the next 9 days. Neglect in turning causes uneven ripening. At the end of 9 days the cheese will have begun to shrink away from the edges of the hoops, and to get soft on the outside. They are then removed from the hoops and scraped with a knife. The scraping makes a smooth, even surface, fills up cracks and aids in the production of the much-desired wrinkling of the rind. After the cheese have been scraped they are bandaged with cheese cloth and cap cloths and returned to the hoops till the following

day, when they are again scraped, if necessary, and a clean bandage pinned loosely about the cheese. They are now placed on draining boards or shelves, without the hoop, and left for 2 or 3 days, or until the growth of mold begins on the outside. On the appearance of mold, the bandage is removed and the cheese removed to a damp curing cellar, where the temperature should be maintained as near 55° F. as possible. Here the cheese are left for several months, and twice a week should be turned on the shelves. The shelves should be kept in a clean condition and clean cloths placed under each cheese. If molded bread crumbs are not mixed with the curd, the cheese are pierced or skewered at the ends to permit the entrance of mold into the center of the cheese.

When ready for market, Stilton cheese present a drab-colored, rough, wrinkled surface, a mellow, soft texture, a marbled or mottled color due to the growth of a blue mold (Pencillium glaucum), and the flavor resembles that of butternuts. The retail price for Stilton cheese sometimes reaches 75 cents a pound.

Composition of Stilton Cheese.

Fat	36%
Casein	26%
Water	32%
Ash, salt, acid, etc.	6%
	100%

Gorgonzola Cheese.

Gorgonzola cheese belongs to the blue molded variety and originated in Italy, being named after the village of the same name. A large quantity is imported into America annually. Gorgonzola cheese are cylindrical in shape, about 12 inches in diameter and 4 inches high. The surface is covered with a thin coating resembling clay, prepared by mixing barite or gypsum, lard and coloring matter. When received in America they are wrapped in paper and packed with straw in wicker baskets and retail for about 50 cents a pound.

Method of Manufacture.

Gorgonzola cheese is made equally well from the milk of cows and goats. It is made from two separately made curds, similar to the procedure in making Stilton cheese. Fresh, clean morning's milk is brought to a temperature of 82° F. and coagulated by the addition of 4 ounces of rennet extract to each 1,000 pounds of milk. When firmly coagulated, it is cut into very small pieces and placed in draining cloths in a curd sink. Every hour during the day the cloths are tightened about the curd, to assist in expelling the whey. In about 8 hours from the time of adding the rennet the curd is cut into pieces about 4 inches square and left under a cotton cover till the following day.

The night's milk is made up in a similar manner, but instead of cutting the curd into pieces 4 inches square, it is broken up and mixed with the curd of the morning's milk. A small quantity of molded bread crumbs is also mixed with the curds. The idea of mixing the older curd with more acid and the newer one is to secure a more or less porous body in the cheese, as two curds of different temperatures and acidity do not unite as readily as the particles of a single curd. The open body is conducive to a growth of mold in the cheese. This is stimulated by the addition of moldy bread crumbs, which act as a "starter."

After the curds have been mixed they are packed loosely into the forms, which are lined with cheese cloth, and placed on straw matting. The curd is not pressed. It is left to unite under its own weight. To bring this about, the forms should be turned every few hours for about 5 days and clean cloths put on occasionally. When the cheese have assumed their proper form they are placed in a moist room, at 68° F. In 2 or 3 days a fine growth of white fungus will have started on the outside. This indicates that the cheese are ready for salting. The surface of the cheese is then entirely covered by gently sprinkling on the salt and then rubbing it in with the hands. Salt is ap-

plied in this manner each day for at least 14 days. When this process has been completed the texture of the cheese should be examined. If it is too close to permit the proper growth of mold, the cheese is pierced a number of times in both ends with metal skewers. The holes thus formed admit oxygen, which is necessary for the growth of mold. The cheese are then placed in a moist curing room, at 55° F., upon straw mats, and turned twice a week until 12 weeks old, when they should be ready for market. In Italy the cheese are cured in caves, where a soft breeze continually blows. During the ripening process several varieties of mold grow on the outside of the cheese, but this coating is removed before the cheese are prepared for market.

Composition of Gorgonzola Cheese.

Fat	34%
Casein	26%
Water	36%
Salt, acid, ash, etc.	4%
	100%

Roquefort Cheese.

Roquefort cheese is of French origin and receives its name from the village of Roquefort. It belongs to the firm, molded type, resembling very closely the Stilton variety. The cheese,

which are round and flat, measure about 8½ inches in diameter, 2 inches deep, and weigh 4 to 5 pounds. Roquefort cheese is one of the most popular varieties of molded cheese and sells for about 60 cents a pound in America. Recently it has been put up in sealed jars, similar to the well-known club cheese, and in this form it seems to meet with favor.

Method of Manufacture.

The real Roquefort cheese is made from the milk of sheep and goats, but a very good imitation can be made from cow's milk. Clean, sweet milk is placed in a cheese vat and ripened by the addition of ¼% to ½% lactic acid culture to an acidity of .18%. The temperature is raised to 90° F., and rennet extract, diluted in 10 times its volume of cold water, is then added at the rate of 3 ounces per 1,000 pounds of milk. Three minutes gives sufficient time for mixing rennet with milk. In 10 to 15 minutes after the rennet is added the milk begins to coagulate, but it should be left undisturbed for 60 to 90 minutes, when it is cut with very coarse knives into cubes about 1 inch square. A good rule for determining the time of cutting is to multiply the time from adding the rennet to first thickening by 6.

After cutting, the curd is not stirred, but settles to the bottom of the vat. The whey is then

removed and the curd dipped into the hoops, which are lined with cheese cloth. The acidity of the whey at the time of dipping should not be above .15%. In filling the hoops, special care is necessary. Each hoop is filled one-third full, then a thin layer of molded bread crumbs, then one-third more curd, another layer of molded bread crumbs, and the filling layer of curd. The object of using the molded bread crumbs is to start a growth of mold through the cheese, which is necessary for the proper ripening.

When the hoops are filled, light pressure (10 pounds) is applied for 1 hour. The cheese are then turned in the hoops, rough edges are trimmed off, the press cloths are dipped in hot water and wrapped around the cheese, which are then returned to the press for 12 to 14 hours. On the morning after the cheese are made they are taken from the hoops and wrapped in fresh, wet cotton cloths and placed on shelves in a curing room, where the temperature should be kept at 58° F. and the relative humidity at 80%. Here the cheese remain for 10 to 12 days, being turned on the shelves every day and fresh cloths put on. Patches of a thin coating of blue mold may appear on the surfaces, and this is wiped off each day. At the end of 10 or 12 days the cheese are rubbed thor-

oughly with dry salt and transferred to the second curing room, or ripening cave, where the temperature should be kept below 50° F., with good ventilation. In France natural caves provide these conditions, but in America our ice-cooled rooms answer the purpose. After the cheese have been in the cool-room or cave for 2 or 3 days they are scraped with a knife and rubbed with a dry cloth or brush. This treatment tends to prevent an increased growth of mold on the surface. A cheese should be sampled at this time with a cheese trier, and if the mold is not spreading through the interior, a number of holes should be pierced in each end with a steel wire or needle. This is done to admit air, which is necessary for mold growth. In large factories the scraping, brushing and piercing are done by machinery.

Roquefort cheese are usually ready for consumption when 4 to 6 weeks old, but continue to improve for several months. A good Roquefort cheese has a pronounced, rich nutty flavor; the texture is similar to our well-made home-trade cheddars, and the whole interior is evenly penciled or marbled with mold, giving a greenish mottled appearance. When ready for market they are wrapped in paper or tinfoil and packed in boxes.

Composition of Roquefort Cheese.

Fat	34%
Casein	28%
Water	30%
Ash, salt, etc.	8%
	100%

Munster Cheese.

Munster cheese receives its name from the city of Munster, in Germany, but they are made in other countries, including America. These cheese have a characteristic flavor, obtained by the addition of caraway seeds. They are cylindrical in shape, about 7 inches in diameter, weigh about 3 pounds, and retail for 15 to 20 cents per pound.

Method of Manufacture.

Clean, fresh milk is heated in a cheese vat to 90° F. Usually no ripening of the milk is necessary, but if the milk is obtained in a fresh condition, the addition of a small amount of commercial starter is advisable, as it insures a good flavor in the cheese and assists materially in preventing gas formation. When the acidity of the milk has reached .16%, rennet extract, diluted in cold water, is added at the rate of 3 ounces to each 1,000 pounds milk. In about 30 minutes the milk should be firmly coagulated and is then cut with the regular curd knives. The curd is not stirred, however, but is allowed

to settle to the bottom of the vat, where it remains for 30 to 45 minutes, or until the acidity of the whey reaches .12%. The whey is then siphoned off and the curd scooped into the forms after the caraway seeds have been mixed with it at the rate of 1 ounce to 100 pounds curd. The form is lined with cheese cloth before receiving the curd, and is usually made in two parts. In 8 to 10 hours after the curd is put in the form the upper half of the form is removed, then the bandage is taken off and the cheese placed in the top half of the form, where it remains for 4 or 5 days, being turned twice each day. At the end of this time the cheese is taken out and rubbed with salt three days in succession, when it is transferred to the ripening cellar, which should contain about 70% moisture and have a uniform temperature of 55° F. It usually requires 6 to 8 weeks for Munster cheese to get ready for market. During this time they should be turned at least twice a week on the shelves. When ready for market they are wrapped in parchment paper or tinfoil and packed in boxes.

Composition of Munster Cheese.

Fat	30%
Casein	22%
Water	42%
Ash, salt, acid, etc.	6%
	100%

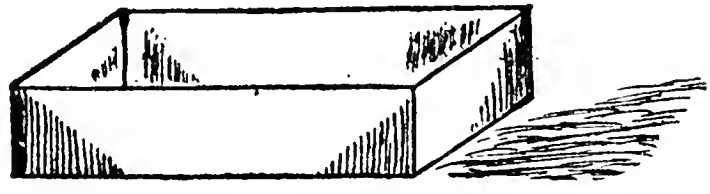
Pont L'Eveque Cheese.

This cheese receives its name from a locality in France, where a large amount of the cheese is manufactured. They are oblong in shape, about 1 inch thick and weigh about 16 ounces. They have a tough rind and the texture is somewhat like that of Brie cheese, only firmer, owing to the more rapid and more thorough expulsion of whey during the manufacturing process.

Method of Manufacture.

Clean, whole milk is placed in a cheese vat, heated to 90° F. and ripened to an acidity of .17%. The ripening is best accomplished by the addition of a small amount of lactic acid (¼% in fresh milk). This stimulates the curing or ripening of the cheese and insures a good flavor. When the proper degree of acidity is reached the milk is colored by the addition of ½ ounce of annatto to each 1,000 pounds. Rennet extract, diluted in cold water, is then added at the rate of 3 ounces per 1,000 pounds milk. In 30 minutes the milk should be firmly coagulated, when it is cut with coarse curd knives into cubes ½ inch square. Immediately after cutting, the curd is placed on straw mats or on the cotton-covered rack of a curd sink, and as soon as all free whey has escaped the curd is transferred to the forms, which are placed on straw mats. The cheese are left in the forms

for 3 days, and during this time the forms are frequently turned, so that both surfaces of the cheese become free from openings and marked with the ridges of the straw matting. At the end of the third day the forms are removed and the cheese are rubbed with salt. While in the forms the temperature of the room should be kept at 65° F. and the humidity at 70%. After salting, the cheese are placed in a dry, well-ventilated room for 2 or 3 days and then transferred to the curing cellar, where the temperature should be 55° F. and the moisture content



Pont L'Eveque Cheese Form.

of the air 80% to 85%. In the course of a few days a growth of mold starts on the outside of the cheese and soon covers the entire surface. The coating of mold is not allowed to become so pronounced as on some of the other varieties of cheese, and every few days is partly removed by washing the cheese in a solution of 1 ounce of salt in every 5 pounds of water. It usually requires about 4 weeks for Pont l'Eveque cheese to become ready for market, and the successful manufacture of the cheese depends very largely upon the careful control of the moisture

content and temperature of the ripening cellar. The yield averages about 1 pound to 10 pounds of milk.

Composition of Pont l'Eveque Cheese.

Fat	28%
Casein	22%
Water	46%
Salt, ash, acid, etc.	4%
	100%

Port Du Salut Cheese.

This cheese originated in the Trappist Abbey, Port du Salut, in France, and is considered one of the most delicious varieties sold in Europe. It is circular in form, 7 inches in diameter, flat, about 1 inch thick and weighs about 1½ pounds. The outside or rind of the cheese is firm and hard, but the inside is mellow and smooth, resembling somewhat the texture of a well-ripened soft home-trade cheddar cheese. The body is more or less porous and the flavor is what we usually term rich, creamy and nutty.

Method of Manufacture.

Clean, whole milk is heated in a cheese vat to 90° F., ripened to an acidity of .17% by the addition of a small amount of lactic acid culture, and colored with annatto at the rate of ½ ounce to 1,000 pounds of milk. When the proper degree of acidity has been reached, rennet extract

diluted in cold water is added at the rate of 4 ounces per 1,000 pounds of milk. In 30 minutes the milk should be firmly coagulated, when it is cut into small cubes about ⅛ inch square. Immediately after cutting, the curd is stirred, to keep the particles separated, and the temperature is raised to 102° F. The time required for heating is 15 to 20 minutes, depending largely upon the amount of milk in the vat and the acidity. The curd is then allowed to settle to the bottom of the vat and the whey is siphoned off. The curd should then be hand-stirred for 2 or 3 minutes, after which it is transferred to the forms and pressure of about 5 pounds applied to each cheese for 10 to 12 hours. During this time the cheese are frequently turned in the forms, the cloths removed, dipped in hot water and rewrapped around the cheese. This is done to insure a good rind formation. After 12 hours' pressing, the cheese are removed from the forms, cloths removed, and salt rubbed into the cheese surfaces. In 24 hours the cheese are placed on shelves in the curing cellar, which should be maintained at a uniform temperature of 55° F. and have a moisture content of 90%. It usually requires Pont du Salut cheese 4 to 6 weeks to become ready for market. During this time they should be turned twice a week on the shelves, and if mold accumulates on the

surfaces, it is removed by washing the cheese in a solution of 1 ounce of salt to 5 pounds of water. These cheese usually retail for 20 to 25 cents per pound, and the yield averages about 11 pounds per 100 pounds of 4% milk.

Composition of Port du Salut Cheese.

Fat	28%
Casein	22%
Water	46%
Ash, salt, acid, etc.	4%
	100%

Caciocavallo Cheese.

This is an Italian cheese, but is made in limited quantities in America, from skimmed milk. The cheese weigh about 3 pounds each and have a peculiar shape, resembling the sole of a shoe,

Caciocavallo Cheese.

there being a restriction at one end, caused by the cord with which they are suspended while drying. Being oval and thick, the shape has been compared to that of a long beet.

Method of Manufacture.

Three parts separator skimmed milk and 1

part whole milk are placed in a cheese vat, heated to 90° F. and ripened by the addition of ½% to 2% commercial starter or buttermilk to an acidity of .21%. Rennet extract, diluted in cold water, is then added at the rate of 2 ounces per 1,000 pounds of milk. In 25 to 30 minutes the milk should be firmly coagulated, when it is cut into small cubes by the regular cheddar curd knives. The curd is not stirred, but is allowed to settle to the bottom of the vat, where it remains for several hours, or until the acidity of the whey reaches .50%. Direct steam is then turned into the whey and the temperature is raised to 165° F. This temperature is maintained for 20 minutes, and during this time the curd is stirred with an iron rake. The whey is then removed and the curd kneaded by hand until all free whey escapes and the texture becomes stringy. It is then molded by hand into the desired shape and placed in a salt brine strong enough to float an egg, for 2 or 3 days. When removed from the brine the cheese are suspended in pairs, from hooks in the ceiling, by cords tied tightly around the cheese about 2 inches from the end. While hanging from the ceiling they are lightly smoked with the smoke of burning wood and transferred to a cool, dry room, where they remain suspended until ready for market. During the curing stage the cheese

become hard and dry, and it may be necessary to rub the surfaces occasionally with boiled linseed oil to prevent their cracking. Caciocavallo cheese may be marketed when 2 months old, but remains in good condition for years. It is very seldom eaten in large pieces but it grated and used for making macaroni foods and for flavoring soups.

Composition of Caciocavallo Cheese.

Fat	30%
Casein and albumin	38%
Water	24%
Ash, salt, acid, etc.	8%
	100%

Ricotto, Whey or Ziger Cheese.

This variety of cheese consists largely of albumin and is made in nearly all countries, from the whey obtained in the manufacture of other cheese.

Method of Manufacture in America.

The whey is placed in a cheese vat or wooden tank, ripened by the addition of 5% sour whey to .30% acidity, and heated by direct steam to 175° F. After standing undisturbed for 10 minutes the fat rises to the surface and can be skimmed off. When the fat has been removed, enough sour whey is added to bring the acidity up to .40%. Live steam is then turned

into the whey and the temperature raised to as near 212° F. as possible. The albumin soon rises to the surface in a flaky condition and is skimmed off. Should difficulty be experienced in collecting the albumin, the addition of 2 to 3% buttermilk before the last heating will be found of assistance, but the casein of the buttermilk may cause dry granules in the cheese. When the albumin has been removed from the whey it is salted at the rate of 1½ ounces to 10 pounds of the curd, and packed in stone jars, where it remains until sold. The cheese usually kept in a soft condition by being covered with whey, but a much better product can be made by mixing one part of cream with 3 parts of albumin. This can be put up in small packages, wrapped in parchment paper or in small paper pails similar to those used for cottage cheese.

Composition of Ricotto Cheese.

Fat	5%
Casein and albumin	20%
Water	68%
Ash, salt, acid, etc	7%
	100%

Camembert Cheese.

Camembert cheese is a soft, molded cheese of French origin, but now made successfully in

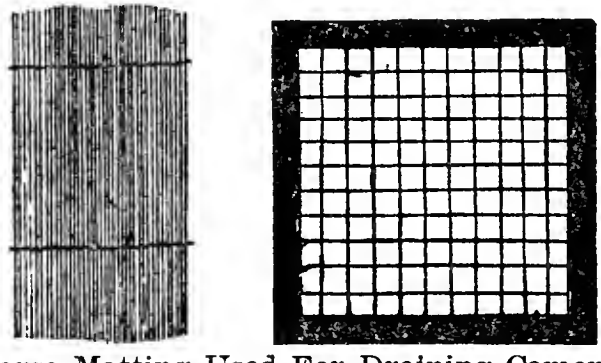
America. A large quantity is imported from France annually, but the American made cheese are being gradually recognized and improved in quality to such an extent that they are rapidly replacing the imported goods. The delicious flavor and creamy texture makes it one of the most popular and high priced fancy cheeses on the market. Each cheese is about 4¼ inches in diameter, 1½ inches thick and weighs about 10 ounces. As seen on the market, they are wrapped in parchment paper or tinfoil, packed in individual thin wooden boxes, and retail for about 35 cents each.

When the manufacture of Camembert cheese was first attempted in America many difficulties were encountered, but most of these have now been overcome, largely through the experimental work done at the Storrs Experiment Station. The details of the manufacturing process, as herein stated, are similar to those followed at Storrs and at the New York State College of Agriculture.

Method of Manufacture.

Clean, sweet milk, from which ½% of the fat has been removed, is ripened by the addition of ½% to 1% lactic acid culture to an acidity of 0.20% to 0.23%, preferably 0.21%, and heated in a cheese vat to 86° F. If colored cheese are desired, the annatto color is now

added at the rate of 12c.c. per 1,000 pounds milk. When the proper temperature and acidity have been secured, the milk is transferred to funnel-shaped cans holding about 50 pounds each. Rennet extract, diluted in 10 times its weight of cold water, is then added at the rate of 120 c.c per 1,000 pounds of milk and mixed evenly through the milk. It is advisable to add the rennet to the cans at short intervals, so

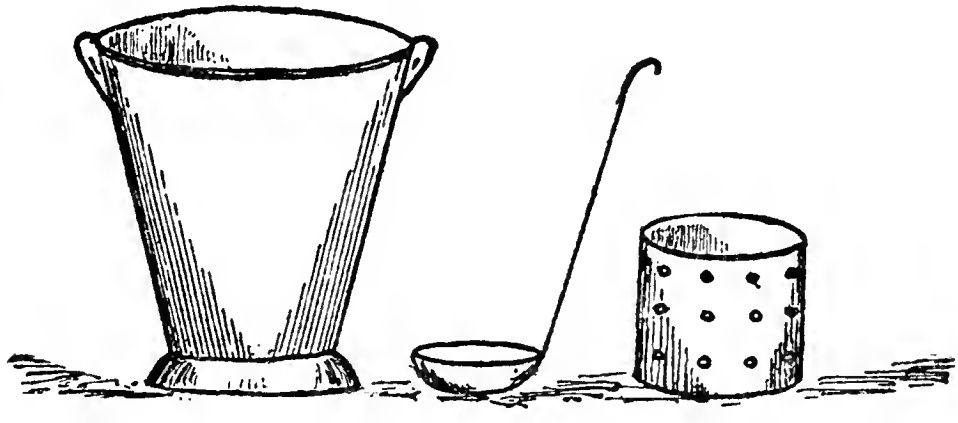


Fine and Coarse Matting Used For Draining Camembert Cheese.

that all will not be ready to dip at the same time.

In 1½ to 2 hours after adding the rennet the milk will be firmly coagulated and the whey will have started to separate, showing first in small drops and later in a thin layer on the surface. The acidity of the whey at this time should be .16% to .17%. The curd is now ready to be transferred to the hoops, and is accomplished by the aid of a small, shallow dipper. A dipperful of the curd is placed, with as little breaking as possible, in each hoop and the process repeated until all the hoops have been filled.

Before receiving the curd, the hoops are placed on straw matting on a draining table and the hoops and matting both thoroughly wet with warm water, so as to prevent the curd sticking when the hoops are turned. Sometimes the curd is cut with a curd knife before dipping, but this is not advised unless difficulty is experienced in getting the curd to contract. After



Camembert Setting Can, Dipper and Hoop.

being filled, the hoops are placed in a well-ventilated room at 68° F. and allowed to drain for 18 hours, when they are turned. When ready to turn, the cheese should have a sort of elastic softness, firm enough to permit turning with the hand without the removal of the hoop. This turning is usually done the first thing in the morning of the day after the cheese is made. In some factories, after dipping, disks of heavy tinned iron, which fit the hoop closely, are dropped upon all freshly dipped cheeses. These

disks are claimed to prevent unevenness of surfaces. They exert a slight but continuous pressure upon the curd. A sucking disk of rubber on the end of a handle is used to remove these in the morning.

After turning, the cheese are allowed to drain for a few hours, then removed from the hoops and salted with coarse, dry salt by gently dusting it over all the surfaces. The salt causes a rind to form on the fresh cheese and assists in expelling some of the whey. After salting, the cheese are placed upon salting boards, where they remain for 30 to 42 hours, when they should be ready to be placed in the curing room.

Cheese Ripening.

The ripening process is undoubtedly the greatest factor in determining the quality of Camembert cheese. The ripening agents are:

1. Rennet extract, which digests the casein.
2. Lactic acid bacteria and their products, which affect the milk sugar, and indirectly the casein.
3. Chemical substances, formed by the action of bacteria on milk products.
4. Camembert mold, which grows on the cheese surfaces and is largely responsible for the changing of the solid curd to creamy condition.

5. Oidium lactis and the species of bacteria which form a reddish slime on the cheese surfaces during the ripening process.

The factors which control or are controlled by the ripening agents are: 1. The moisture (whey) content of the cheese. 2. The temperature of the ripening roofs. 3. The amount of moisture in the air of the ripening rooms.

In a few days after the cheese are placed in the first curing room they become partly covered with a coating of mold of a greenish color. When one first starts to make Camembert cheese it is necessary to send to a bacteriologist for a culture of Camembert mold with which to inoculate the cheese and rooms. Before the first lot of cheese are salted, some of the mold culture is mixed with water and sprayed over the cheese, as well as on the walls and floors of the curing and making rooms. After that the mold will usually form on all cheese without further inoculation.

Care of Cheese in the Curing Rooms.

The first curing room should be kept at a uniform temperature of 52° to 56° F., and the moisture content of the air at 85% to 90%, depending on the dryness or wetness of the cheese. For the first 2 weeks the cheese are placed on coarse matting (clayons) and turned every 2

or 3 days to insure uniform ripening. During this time the surfaces become covered with moderately thin areas of mold and patches of reddish slime. Traces of softening under the rind show at the end of 2 weeks and the cheese are then transferred to smooth boards or wrapped in paper or tinfoil and boxed. It is claimed that wrapping in tinfoil produces a stronger flavored cheese than when paper is used, but the tinfoil has proved the most satisfactory at the New York State College of Agriculture.

During the next 2 weeks the care of the cheese will depend largely on their condition. If they are ripening favorably they may be left in the same curing room, but if they appear to be too moist they should be transferred to a second curing room, where the air is dryer, and possibly 1° or 2° cooler. Usually the cheese are left on the boards until ready for market, but if they show signs of going out of shape they are better to be placed in the boxes. While on the boards they should be turned every day to prevent their adhering to the wood and breaking.

At the end of 4 weeks the cheese should be softened all the way through to a creamy consistency, and the flavor should be mild and pleasant. They are then ready for consumption. In actual practice, however, they are usu-

ally boxed and sent to market when between 2 and 3 weeks old, the ripening being completed during transportation or while in the stores of retailers or commission men.

About 4 pounds of 4% milk are required for each cheese, so it can be seen that the industry is a profitable one when well understood and carried on without losses. For further reference the reader is referred to Bulletin No. 58 prepared by Dr. Charles Thom, of the Storrs Experiment Station.

Composition of Camembert Cheese.

Fat	46%
Proteids	32%
Water	19%
Ash, salt, etc	3%
	100%

Brie Cheese.

Brie cheese is a soft, molded French cheese of the Camembert type and is made in considerable quantities in America. They are made in several sizes, the most common being about 2 inches in height and 12 inches in diameter. Brie cheese is somewhat easier to make than Camembert, and consequently does not sell for so high a price, but, nevertheless, in many places they sell for as high as 25 cents a pound, thereby yielding the manufacturer a good profit,

as 12 to 14 pounds can be made from 100 pounds of 4% milk.

Method of Manufacture.

Clean, sweet milk is ripened in a cheese vat at 60° F. by the addition of ¼% to ½% lactic acid culture to an acidity of .19%. It is then heated to 84° F. and coloring added at the rate of ½ ounce (15c.c.) per 1,000 pounds of milk. As soon as the coloring has been evenly distributed, the milk is transferred to the setting cans (similar to Camembert), where rennet extract, diluted in cold water, is added at the rate of 4 ounces per 1,000 pounds of milk. The milk begins to coagulate in 10 to 15 minutes, but should be left undisturbed for 2 hours, when it is dipped carefully into the hoops, which are placed on fine matting on a draining table. The hoops are filled with curd, but it rapidly shrinks as the whey leaves it. In 4 to 5 hours the cheese will have become somewhat firm and have assumed their form. The hoops are then turned, so that the draining may be uniform and both ends of the cheese may become marked with the impression of the straws in the matting. The cheese are left over night in the make room, where the temperature should be kept at about 65°. On the following morning the hoops are again inverted, but the position of the matting is changed, so that the marks of the straws will

be crossed, causing a number of little points to appear on the surface of the cheese, instead of lines. In 4 or 5 hours the hoops are turned once more, so that both surfaces of the cheese may be marked alike. In 2 or 3 hours the hoops are removed and the cheese salted by sprinkling coarse, dry salt over the surfaces. They are then placed on smooth boards in a drying room, where the temperature should be kept at 56° F. and the relative humidity about 70%. Here the cheese remain for 8 to 12 days, being turned every day, and during this period they become covered with white and blue mold and areas of reddish slime. At the end of 12 days, or as soon as the cheese have begun to soften, they are placed on coarse matting and transferred to another cellar or room, where the temperature should be kept at 52° F. and the relative humidity at 85% to 90%. Here the cheese remain until ready for market, being turned every 2 or 3 days. Brie cheese are considered salable when the interior has assumed a yellow color and a creamy texture. They are then wrapped in parchment paper and packed in boxes. When markets are some distance from the factory the cheese are often boxed at an earlier date and allowed to finish the ripening during transportation or while in the stores of the dealers.

Composition of Brie Cheese.

Fat	27%
Casein	19%
Water	50%
Salt, ash, etc	4%
	100%

Oka Cheese.

Oka cheese is a fancy variety of the type of soft molded cheeses, made exclusively in the Oka Trappist monastery in the Province of Quebec, Canada. The cheese, which are flat and circular, measure about 10 inches in diameter and 2 inches thick. The flavor resembles that of Brie cheese, but the texture is more waxy. The actual details of the manufacturing process are kept secret, but from an examination of the finished cheese it is quite evident that the process is very similar to that used in making Brie.

Goat's Milk Cheese.

While it is possible to make nearly all varieties of cheese from goats' milk, there is one particular variety made in many foreign countries that is known exclusively as goats' milk cheese.

Method of Manufacture.

The fresh milk is heated to 90° F. and coagulated by the addition of 9c.c rennet extract to each 100 pounds of milk. In 45 to 60 minutes

the coagulated milk is cut into small cubes by the regular curd knives, and stirred gently with the hand or a wooden rake for 15 minutes, when the whey and curd are dipped into small perforated tin molds placed on straw matting. The molds should be turned every 30 minutes for several hours until all free whey has drained off and the cheese are firm. Salt is then sprinkled over the upper surface. In 24 hours the cheese are again turned and salt rubbed into the other surface, as well as on the sides. When ready for market, goats' milk cheese measure 3 inches in diameter and 2 inches deep and weigh ½ pound. They should be ripened for at least 20 days at a temperature of 60° F. before marketing, when they become mellow in texture, with a characteristic flavor, resembling sweitzer.

Composition of Goats' Milk Cheese.

Fat	36%
Casein	23%
Salts, acid, etc.	6%
Water	35%
	100%

Limburg Cheese.

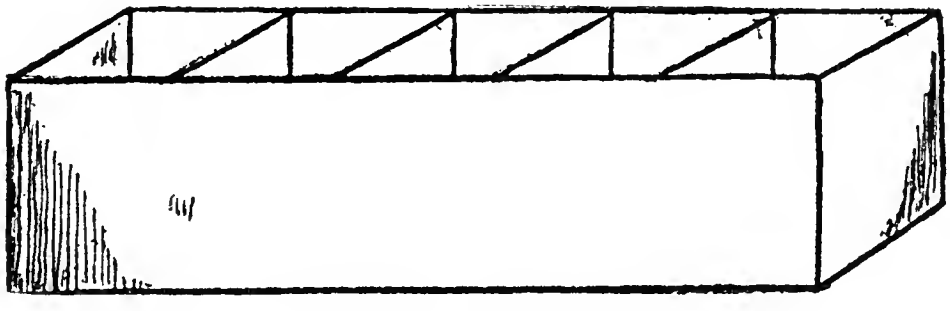
Limburg is a soft rennet cheese that originated in Belgium, where it was marketed at the town of Limburg. Very little Limburg cheese

is imported into this country now, however, most of it being made in the states of New York and Wisconsin. This cheese is recognized by its strong odor and characteristic taste and can be made with success by the average cheese-maker.

Method of Manufacture.

Fresh, clean, sweet milk is necessary for the manufacture of Limburg cheese. For this reason the cheese are made twice each day during the hot weather of the summer months. Pasteurization of the milk, however, eliminates this and insures a reliable and uniform raw material. When the milk is pasteurized and cooled, two c.c. of a 25% solution of calcium chloride should be added, to restore the coagulative power. The milk is set at a temperature of 90° F., with enough rennet (2½ ounces to 1,000 pounds of milk) to coagulate it fit for cutting in 30 minutes. The setting temperature can be varied slightly according to the temperature of the room and the acidity of the milk. The acidity of the milk at the time of adding the rennet should not be over .17%. When milk is pasteurized, ½% commercial starter is used to produce the proper fermentation. As soon as the milk is firmly coagulated it is cut into cubes not smaller than ⅜ inch square, by using the perpendicular curd knife, first lengthwise of the vat

and then crosswise. The curd is then stirred gently with a wooden rake or agitator and in 10 minutes the steam is turned on and the temperature raised in 30 minutes to 96° or 98° F. When this temperature has been reached, one-half the whey is drawn off and the curds stirred until the cubes shrink to about three-fifths their original size. The acidity of the whey should then be not over .15%, and about 45 minutes should have elapsed from the time of cutting. The



Limburg Cheese Mold.

mixture of whey and curd is then dipped into the molds, which have been placed on a draining table covered with burlap. The molds are filled and in 15 minutes, or as soon as the curd has settled and matted, are turned bottom side up. They are again turned every hour for 4 or 5 hours, by which time they will have become molded into shape and all free whey will have escaped. They are then taken to the curing cellar, rolled in salt and placed flat side down upon a salting table or shelf. The salting oper-

ation is repeated once a day for 3 days, when they are placed on end on the curing room shelves. Limburg cheese should be ripened in a damp cellar at a temperature as near 60° F. as possible, and should not be marketed before they are at least 5 weeks old. During this time they should be turned on the shelves every 2 or 3 days and rubbed by hand. If the surfaces become too dry, they should be moistened with warm water or whey. Limburg cheese measure 5 inches square and 2 inches thick and weigh about 2 pounds. About 8 pounds of milk is required to make 1 pound of cheese. The ripening starts at the outside of the cheese, and in about 2 weeks they begin to turn yellow. The molds are made of ½-inch wood, 28 inches long, 5 inches wide, 5 inches deep, and divided into 5 compartments, so that 5 cheese can be molded at one time. While wood is used entirely, molds of galvanized iron are much more sanitary. Any form of draining table will suffice, so long as it has sufficient slant to allow the whey to drain away freely.

When the cheese are ready for market they are wrapped in waxed paper, or frequently in tinfoil, and packed in boxes of different sizes for shipment.

Composition of Limburg Cheese.

Fat	30%
Casein	29%
Water	36%
Ash, salt, acid, etc.	5%
	100%

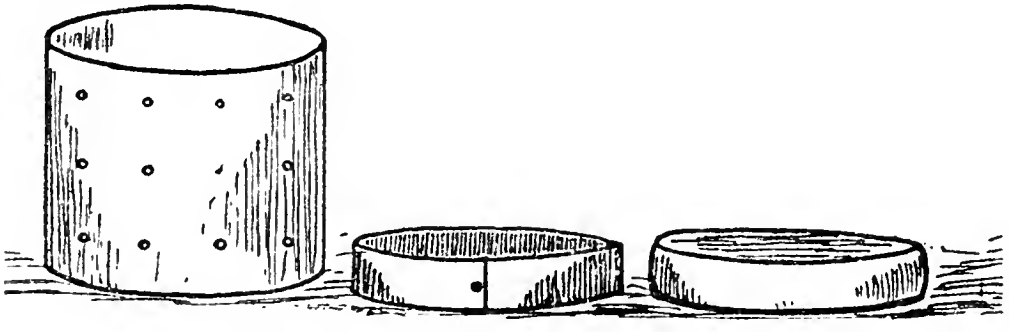
Isigny Cheese.

Isigny cheese is of American origin, resulting from attempts to make Camembert cheese. It is recognized in two classes, the ripened and the unripened. The unripened is somewhat firm and mild and resembles freshly salted cheddar curd. The ripened class is much softer, strong in flavor and resembles Limburger. It results from keeping the unripened variety for several weeks at a temperature of 70° F. Isigny cheese are flat and cylindrical in shape, measure 5½ inches in diameter and 1½ inches deep and weigh a little over 1 pound.

Method of Manufacture.

Sweet, clean milk, with an acidity of .18%, is heated to 90° F. and ¼% commercial starter added. For each 1,000 pounds of milk 2 ounces of rennet extract, diluted in 20 times its weight of cold water is then stirred thoroughly through the milk for 3 minutes. In 45 minutes the milk should be firmly coagulated, when it is cut into

cubes about 1 inch square. It is then stirred gently for 10 minutes until the cubes of curd begin to contract, when the mixture of whey and curd is dipped into the molds. The molds are made of perforated tin and are 5½ inches in diameter and 5 inches high. They should be placed on corrugated matting and filled to the top with curd. As the whey drains away from the curd the molds should be turned every hour for 4 or 5 hours. By this time the cheese will



Isigny Mold, Salting Mold and Cheese.

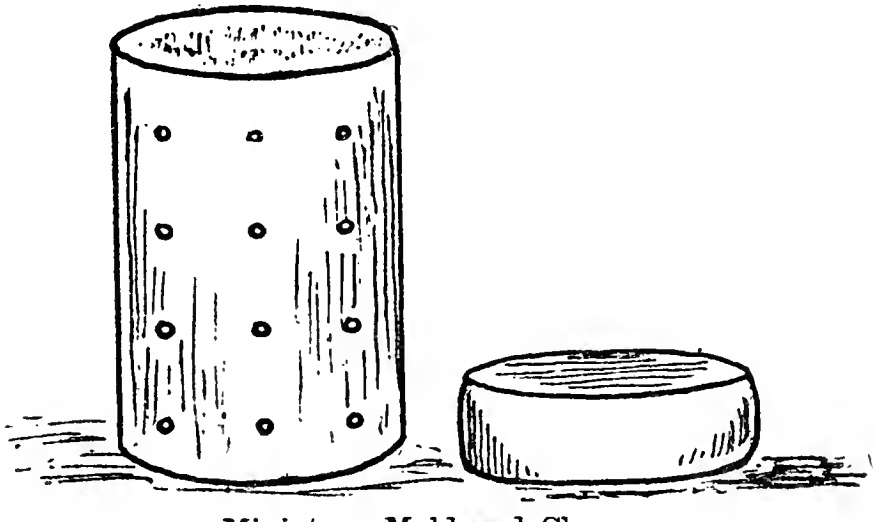
have assumed a regular shape and size. The following morning they are taken from the molds and the surface rubbed with salt, which penetrates the interior. They are then placed in salting molds, which consist of a band of tin large enough to keep the cheese in shape. In about 5 days the cheese can be wrapped in parchment paper, packed in Isigny cheese boxes and sent to market. A hundred pounds of 4% milk will make about 15 pounds of Isigny cheese, which retails for at least 20 cents a pound.

When the ripened cheese are desired, they

should be kept in a moist room at a temperature of 70° F. for 5 or 6 weeks, when they become softer in texture and stronger in flavor. During the ripening process they should be frequently washed or rubbed to prevent the growth of molds on the outside.

Miniature Isigny Cheese.

The only difference between Isigny and miniature cheese is in size, miniature being made in smaller molds, weigh about ½ pound and measure 3¾ inches in diameter and 1½ inches deep.



Miniature Mold and Cheese.

Composition of Isigny Cheese.

Fat	22.00%
Casein	23.50%
Salt, acid, etc.	4.50%
Water	50.00%
	100%

Cottage Cheese (Smear-Case, Dutch Cheese).

In America, cottage cheese is manufactured more extensively than any other variety of soft cheese made from skimmed milk. A considerable amount is used on the dinner table, but the great bulk of it is used by bakers in the preparation of fancy cheese biscuits. For this reason it is often called baker's cheese.

Method of Manufacture.

Cottage cheese is the product obtained by the precipitation of the solids of skimmed milk or buttermilk. This precipitation can be accomplished in several ways: (1) by the development of lactic acid; (2) by the addition of other acids (contrary to law in New York State); (3) by the addition of rennet; (4) by a combination of any two of these. The most desirable method is a combination of one and three, viz., the development of lactic acid by the use of a commercial starter or buttermilk and by the use of rennet. A commercial starter is simply a culture of lactic acid forming bacteria, and can be secured from any of the dairy supply houses.

Skimmed milk as it comes from the separator is cooled to 75° F., or the milk may first be pasteurized at 165° F. for 15 minutes and then cooled to 75° F. Then a sufficient quantity of commercial starter or buttermilk is added. The amount of starter varies from ¼% to 5%, de-

pending on the acidity of the milk, the temperature of the milk, the acidity of the starter and the time allowed for coagulation. When milk is separated in the morning, it should be ready for the addition of rennet early in the afternoon. The acidity should not be over .22% when rennet extract is added at the rate of ½ ounce per 1,000 pounds of skimmed milk, over-acid milk causing defective texture and flavor in the cheese. Coagulation usually takes place in a few hours, but the milk should be left undisturbed and kept at 75° F. until the curd is firm and has begun to separate from the whey. The acidity at this time should be not over .45%. The curd is then scooped onto a large strainer-rack or placed in cotton bags to drain. The expulsion of whey can be hastened greatly by the use of a cheddar cheese press. When all free whey has escaped the curd is packed in milk cans and is ready for shipment. This product is commonly called "baker's cheese."

When cottage cheese is manufactured in small quantities for table use, it is prepared somewhat differently. After the curd has been dried to a firm, smooth consistency, thick cream (sour or sweet) is mixed in, at the rate of 8 ounces to 10 pounds of the cheese. Salt is then added to suit the taste, the usual quantity being 2 ounces to 10 pounds of cheese. After

salting, the cheese is pressed into round balls, rectangular prints or fancy shapes weighing ¼ pound to ½ pound and wrapped in oiled paper or paraffined paper. A convenient way of marketing is in small paper pails holding ¼ to ½ pound each.

One hundred pounds of skimmed milk will make about 22 pounds of baker's cheese, which sells for 1½ to 2 cents per pound, or about 18 pounds of finished cottage cheese, which usually retails for 10 to 20 cents per pound, depending on the quality of the cheese and the manner in which it is marketed.

A New Method for Making Cottage Cheese.

The following is the method followed most successfully by the author in the New York State College of Agriculture:

Pasteurized skimmed milk is cooled to 70° F., and ripened by the addition of lactic acid culture to an acidity of .55%. If the skimmed milk can be secured in the morning 10% commercial starter will produce the desired acidity by three or four o'clock in the afternoon. As soon as the proper acidity has been reached the temperature is raised to 80° F. The casein or curd soon separates from the whey in the form of small particles. When the casein has been precipitated, the milk is churned for 10 to 15 minutes to break the granules into a finer con-

dition. After churning the milk is placed in cans and the temperature raised to 100° F. After standing undisturbed for 60 minutes the curd settles to the bottom. The whey is then siphoned off and the curd placed in cotton bags in a cold room, where it drains over night. In the morning all free whey will have escaped, so the curd is stirred up and salted 1½ ounces to 10 pounds of curd. The remaining procedure is similar to that of cottage cheese prepared by the other method. Cheese made in this manner have a smoother, finer texture than those made by the older method.

Qualities of Cottage Cheese.

Perfect cottage cheese should be clean in flavor, resembling fresh butter. The taste should be mildly acid. The texture should be fairly dry but smooth and entirely free from lumps or grittiness. Cottage cheese will keep in good condition for two weeks or more if kept in a cold place.

Composition of Cottage Cheese.

Water	72.00%
Proteids	20.00%
Sugar, lactic acid, etc.	5.50%
Ash	2.50%
	100.00%

Defects in Cottage Cheese—Causes and Remedies.

1. Defects in flavor.

Unclean, bitter, acidy and food flavors are the important ones.

(a) Causes.

(1) Bacteria, which gain entrance in one or more of the following ways:

(a) Unclean milk supply.
(b) Unclean utensils.
(c) On dirt carried by flies.
(d) Impure starters.
(e) Development of acid.

(2) Flavors of strong smelling foods which the cows have eaten.

(b) Remedy. It is practically impossible to make the cheese any better than the milk supply. Many undesirable flavors can be avoided, however, by pasteurizing part or all of the skimmed milk and ripening with a good commercial starter.

2. Defects in texture.

A. The most common defects are dry, mealy, and lumpy texture.

(a) Causes. Too little moisture or an uneven incorporation of mois-

ture in the cheese, due to one or more of the following causes:

(a) Too high or uneven temperature during the manufacturing process. This usually occurs in cold weather in buildings where the temperature cannot be controlled.

(b) Over-development of acid.

(c) Too rapid drying or uneven drying.

(d) Use of too much rennet.

(e) Uneven coagulation.

(f) Too little acid at the time of dipping the curd.

(b) Remedy. If uniform results are to be obtained the temperatures and acidity must be uniformly controlled. In cold weather the building should be warm. The use of an acidimeter affords an accurate means of determining the amount of acid at all times, and when this is known the development can be controlled by raising or lowering the temperature as desired. Lactic acid forms most rapidly at 90° F., and as this temperature is low-

ered the growth of lactic acid forming bacteria is checked proportionally. An important fact to remember is that the lower the temperature and still have a proper coagulation, the smoother will be the texture.

B. Soft, pasty or mushy texture.

(a) Causes. Too much moisture in the cheese, due to one or more of the following conditions:

(a) Too low temperature of coagulation.

(b) Imperfect coagulation.

(c) Insufficient drying.

(b) Remedy. The precautions given under dry texture apply here as well. When there is an excess of acid it may be partly removed by washing the curd in cold water. The formation of acid may be checked by the addition of part of the salt, by applying ice over the curd, or by placing it in a cold room.

The great secret of successful cottage cheese-making lies in the proper controlling of temperature, acidity and moisture during the entire manufacturing process. A high moisture con-

tent means more whey and therefore more milk sugar, and subsequently a greater and more rapid formation of acid. In dry cheese the formation of acid is slower.

Buttermilk Cheese.

Buttermilk cheese is a product made from the curd of buttermilk. The method of manufacture has recently been described in a bulletin from the Wisconsin Station and is as follows:

Buttermilk of 0.5 or 0.6% acidity, made either from pasteurized or raw cream, is run into a steam-heated vat or starter can, or placed in a pail which can be heated in a tub of hot water. The buttermilk is stirred and heated to 75° to 78° F., when it is covered and left quiet for 1½ to 2 hours. The temperature is then raised to 140° F. and in about an hour the curd will have settled to the bottom. The whey is then removed and the curd transferred to a draining cloth or cotton bag, where it remains over night or until it becomes sufficiently dry. There seems to be little danger of the curd getting too dry, as is the case in cottage cheese, but, while it is draining it should be stirred occasionally as the portions next the cloth dry more rapidly and prevent or delay the draining of the curd in the center.

As soon as all free whey has been expelled from the curd, salt, at the rate of 2 ounces to

each 10 pounds of cheese, is added. The cheese can then be put up in small packages, wrapped in parchment paper or in paper pails similar to those used for ice cream.

Buttermilk cheese is somewhat finer in grain than skimmed milk cottage cheese and needs no added cream to give it the proper texture. One hundred pounds of buttermilk yields from 12 to 15 pounds of cheese, the amount depending on the casein content of the buttermilk and the amount of water retained in the cheese. The cheese sell for the same prices as cottage cheese.

Neufchatel Cheese.

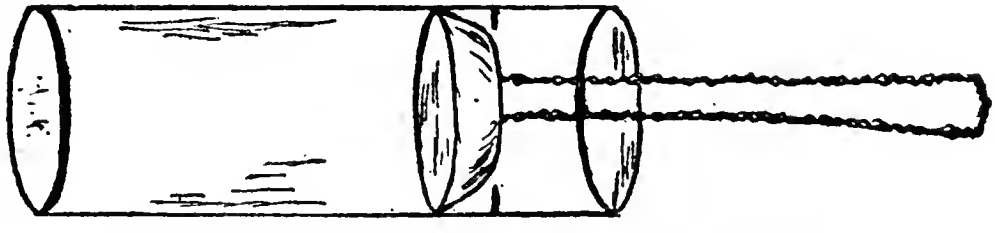
Neufchatel cheese was originally a French make of soft, molded cheese. In this country the process of manufacture has been considerably changed, so that the cheese as now manufactured represents a somewhat different type, that is ready for use as soon as made.

American Method of Manufacture.

Fresh sweet milk is heated to 165° F. for 10 minutes and then cooled immediately to 72° F. Until very recently the milk used was not pasteurized, but the great difficulty in securing reliable milk, together with the advantages of pasteurization and the use of a commercial starter, have made the heating method very popular.

In large factories the cheese is made in large

vats, but on the farm it can be made in smaller quantities in shotgun cans holding about 30 pounds of milk. After the milk is cooled to 72° F. a small amount of commercial starter is added and enough rennet to insure a thorough coagulation in 18 hours. Usually about 1 c.c. of commercial starter and ½ c.c. of rennet extract is sufficient to 30 pounds of milk if the temperature is maintained at 72° F. As soon as the milk is firmly coagulated it is placed on a cotton-covered strainer-rack or in cotton bags to drain. The acidity of the exuding whey at this time should not be over .35% or the flavor of the cheese will be too acid. The draining process requires several hours and should be kept up until all free whey has escaped. Light pres-



Parts of a Neufchatel Cheese Mold in Position.

sure, such as can be obtained in a small cheese-press, aids materially in expelling the whey. During the draining process the curd on the outer and under surfaces of the strainer should be stirred occasionally to insure even drying. As soon as the curd is sufficiently dry, salt is added at the rate of 2¼ ounces to 10 pounds of curd. At this time the acidity of the whey

should not be over .5% The cheese should then be pressed for a short time to expel excess whey. It is then kneaded by hand and finally pressed into small cylindrical shapes 1¾x2¾ inches, weighing one-fourth pound each. Cheese are wrapped in parchment paper and tinfoils 5x7 inches and are then ready for market.

Qualities of Neufchatel Cheese.

Neufchatel cheese should have a distinct, mild, clean flavor resembling well-ripened cream. The texture should be fairly dry, yet smooth and entirely free from lumps. There should be no leaking whey, and each cheese should be neatly wrapped. The cheese will usually keep in good condition for two weeks if kept in a cold place. From 100 pounds of milk about 22 pounds of Neufchatel cheese can be made, which sells for 20 to 40 cents per pound, depending on its quality and the manner of marketing.

Composition of Neufchatel Cheese.

Water	50%
Fat	24%
Proteids	18%
Sugar, lactic acid, etc.	5%
Ash	3%
	100%

Precautions to Observe in Making Neufchatel Cheese.

The making of Neufchatel cheese is easy and very profitable, but in order to secure a uniformly good product each day strict attention must be given to the control of temperatures, acidity and moisture. High temperature, too much rennet, too much acid, too rapid drying and uneven drying all cause lumpy texture. It is very important that the curd be properly coagulated before being placed in the draining process. If it is too soft or breaks up too much in being transferred from the can to the strainer, uneven drying usually results. In hot weather the drying of the curd is hastened and the development of acid retarded by draining and working the curd in a cool room or by covering the curd with consecutive layers of ice.

Cream Cheese.

Cream cheese is one of the most delicious and most largely used American-made fancy cheese. Many concerns enjoy the profits from its sale, but there is still a large market for an increased production.

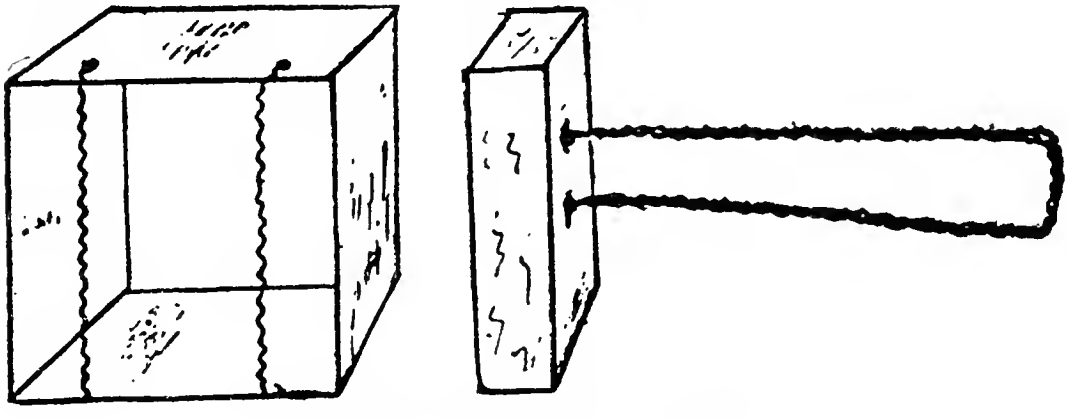
Method of Manufacture.

The method usually followed is similar to that used in making American Neufchatel cheese, except that thin cream testing at least 10% fat is used in place of whole milk. The great disad-

vantage in this method, however, is the danger of a large loss of fat during the manufacturing process. During the long period of coagulation the fat rises to the top and is very difficult to reincorporate without serious loss. To avoid this loss of fat the following method is now much used with excellent results:

Whole milk (pasteurized preferred) is placed in cans holding about 30 pounds each and brought to a temperature of 75° F. One c.c. of lactic acid culture and ½ c.c. of rennet extract are diluted with a few ounces of cold water and added and stirred separately into each can. In about 18 hours the milk should be firmly coagulated and the whey which separates from the curd should have an acidity of about .35%. The curd is then dipped on to a cotton-covered strainer rack, or into cotton bags, to drain. While draining, the contents of the draining bags or rack should be stirred occasionally to insure an even expulsion of whey and prevent the formation of hard, dry particles. As soon as the curd is sufficiently dry, or when all indication of free whey has ceased, 1 to 2 pounds of rich cream is added and then 2¼ ounces of salt to each 10 pounds of cheese. After salting, the cheese should be allowed to stand for at least an hour in a cool place, so that any whey which is still present may escape. If this is not done

the cheese are liable to leak after packing. When sufficiently dry the cheese is pressed, either by hand or power devices, into rectangular shapes 1¼x2¼x2¾ inches and wrapped in parchment paper and tinfoil. Cream cheese of this size will weigh ¼ pound and retails for at least 10 cents each. One hundred pounds of 4% milk, plus the added cream, will make ap-



Parts of a Cream Cheese Mold.

proximately 22 pounds of cheese, so that it yields a large profit.

Average Composition of Cream Cheese.

Water	44%
Fat	40%
Proteid	12%
Sugar, lactic acid, etc.	3%
Ash	1%
	100%

Qualities of Cream Cheese.

Cream cheese should be clean in flavor, with a distinct mild aroma resembling fresh butter.

It should be of a creamy consistency with plenty of body, but entirely free from lumps. When kept in a cold place cream cheese will remain in good condition for at least 10 days, but deteriorates rapidly in hot weather. It makes a very desirable lunch cheese and is much used for this purpose.

Defects in Cream Cheese.

The defects, with their causes and remedies as described under cottage cheese, apply with equal importance to Neufchatel and cream cheese.

Sandwich Nut Cheese.

This style of cheese originated in the Department of Dairy Industry of the New York State College of Agriculture, and is one of the most delicious varieties of soft cheese, being much used in the preparation of cheese sandwiches.

Method of Manufacture.

To 10 pounds of cream cheese add one-half pound of mixed walnuts and almonds. The nuts should first be blanched by soaking in hot water for a few minutes and then removing the dark-colored skins with the fingers. The nuts are ground finely in a meat-mincing machine and mixed evenly through the cheese, which is pressed into the regular cream cheese mold and wrapped in parchment paper and tinfoil. These weigh one-fourth pound and retail at 10 cents each or 40 cents per pound.

Pepper-Cream Cheese or Pimento.

This variety of cheese was first suggested by Mr. J. D. Frederickson of Chr. Hansen's Laboratory, Little Falls, N. Y., and is used considerably by those persons who desire spicy foodstuffs.

Method of Manufacture.

To 10 pounds of American Neufchatel cheese add one-fourth pound to one-half pound of red peppers. The peppers should first be put through a meat-mincing machine and ground to a pulp. The cheese and peppers are then mixed and pressed into rectangular shapes, weighing about one-fourth pound. These usually retail at 40 cents per pound and must be kept in a cool place.

Caraway Potato Cheese.

This is a soft cheese, of rather peculiar flavor, due to the method of manufacture and the ingredients used. The process has recently been developed by the Department of Dairy Industry of the New York State College of Agriculture at Cornell University, and is very simple.

Method of Manufacture.

A small quantity of American Neufchatel cheese is made in the regular way. Before salting, however, mashed boiled potatoes are added

at the rate of 1 pound to 1 pound of cheese. Salt is then applied at the rate of 2 ounces for 10 pounds of cheese. A few caraway seeds are sprinkled over the curd and the whole mass thoroughly mixed in a large wooden dish. The cheese is then pressed into suitable shapes, weighing one-fourth pound each, and wrapped in parchment paper. They are ready for use as soon as made, but improve if kept in a cool place for a few days.

Olive-Cream Cheese.

This cheese also originated in the Department of Dairy Industry of the New York State College of Agriculture, and is used for the same purposes as Sandwich Nut Cheese.

Method of Manufacture.

To 10 pounds of cream cheese add the meat of 2 dozen olives. The olives are first stoned and then ground to a pulp in a meat-mincing machine. The cheese and olives are then mixed and pressed into cylindrical shapes similar to American Neufchatel cheese. These weigh about one-fourth pound each and retail for 40 cents per pound. They are wrapped in parchment paper and tinfoil, and if kept in a cold place remain in good condition for at least 10 days.

Club Cheese.

Club cheese is one of the most common varieties of fancy cheese, being manufactured most

extensively in Canada, New York and Michigan. For those persons who desire a pronounced flavor and taste, together with a smooth soft texture in cheese, the club variety answers the purpose better than any other. One important quality in club cheese is that it can be spread easily on biscuits or bread, and for this reason it is used on almost every occasion when cheese is served.

Method of Manufacture.

The method of making club cheese is very simple and yet it requires considerable skill to manufacture a uniformly good product from day to day. The most important factor is the use of suitable raw material, viz., cheddar cheese and butter of good quality. The amount of each of these constituents to be used is determined by the quality of the cheese used and the keeping quality desired in the club cheese.

The method consists in simply grinding up some well-ripened cheddar cheese of good flavor in a meat-mincing machine and adding a certain amount of good butter to increase the softness and richness of the cheese. If a fairly strong flavored cheese is desired, cheese six months to one year old should be used, while if a milder taste is preferred, cheese about three months old is better. If the cheese to be ground up is dry in texture, it will require more butter to

make it smooth than would be required by a softer cheese containing more moisture. Generally speaking, for home use and for reasonably quick consumption, 1 pound of butter to 8 pounds of cheese make very desirable proportions. The mixture of cheese and butter is usually run through the mincing machine a second time and then kneaded by hand to remove all possibility of lumpiness. In large factories a machine is used for this purpose. Occasionally a small amount of mustard or brandy is added to suit the taste of consumers.

How Club Cheese Is Marketed.

Club cheese is usually packed in glass or wrapped in tinfoil. When jars are used they should be of a size that can be conveniently used on the dinner table or for picnics, lunches, etc.

In packing, the jars are first smeared on the inside with melted butter to prevent air spaces between the cheese and the glass where mold might grow. The jars are filled to within one-quarter inch of the top, covered with plain tinfoil, and then with a tightly fitting cover. When desired in smaller quantities, the cheese can be more profitably put up in small packages, wrapped first in waxed paper and then in tinfoil. Club cheese usually retails for about 40 cents per pound. When stored in a cool place it will keep for some time.

Casein Manufacture.

During recent years the demand for casein to be used in the manufacture of buttons, knife handles, billiard balls, paper sizing, etc., has increased to such an extent that much skimmed milk is now used for this purpose. The different uses to which the prepared casein is put, determine to a great degree the process of its manufacture, but for all general purposes this may be divided into two classes—natural casein and acid cooked casein.

Natural Casein Manufacture.

Skimmed milk is placed in a wooden or tin vat and heated to 115° F. About 10% sour whey or buttermilk is then added and enough rennet diluted in cold water (1 ounce to 5,000 pounds of skimmed milk) to coagulate it in 2 hours. As soon as it thickens, the temperature is raised to 120° F., in order to render the curd tough and firm. After a few minutes stirring with a wooden hayrake, the whey is removed and the curd placed on trays in a drying kiln, after which it is run through a mill and packed in bags for shipment. One hundred pounds of skimmed milk makes about 3 pounds of casein, which markets for 5 or 6 cents a pound. The whey from this process is useful for hog feeding purposes.

Acid Cooked Casein.

Skimmed milk is placed in a wooden vat and heated by direct steam or otherwise to 120° F. Enough sulphuric acid (usually 1 quart to 1,000 pounds skimmed milk) is then added to effect a clear separation of the curd from the whey. The acid should be diluted in 5 times its weight of cold water, and be added gradually so that too much may not be used. Sour milk requires less acid, and an excess causes difficulty in the gathering of the curd into a solid mass. After the curd is precipitated and the whey is clear, it should be drawn off, leaving the curd in the bottom of the vat. The curd is then covered with clean cold water and stirred vigorously so that the water can remove all acid from the curd. This water is drawn off and fresh water put on and heated by direct steam to at least 175° F. The curd is then stirred until it forms into a solid mass about the consistency of bread dough, when the water is removed. The curd is then placed on a shelf or clean floor to dry and sear over. It is then ready for shipment. Sometimes it is dried in kilns at the creamery and ground up before shipping. Casein thus prepared nets only about 15 cents per 100 pounds of skimmed milk. In stirring the milk while adding the acid, a wooden rake is used,

but for stirring the curd in the hot water, a solid iron garden rake is better. The whey from casein made in this way contains much acid and should not be used for feeding purposes.

Cheesemaking Facts.

The cleaner the milk, the better the cheese.

The richer the milk, the richer the cheese and the greater the amount of it.

A clean flavored commercial starter, properly used, determines the flavor of the finished cheese.

Six factors that influence cheese texture are fat, moisture, rennet, salt, bacteria and mold.

The controlling of moisture and acidity is one of the most important problems in all cheesemaking.

No part of cheesemaking equipment is more useful than an acid test.

The lower the temperature necessary to properly firm curd for any cheese, the smoother and better will be the texture of the finished product.

Cheese made in imitation of imported products must be so designated and branded, in order to comply with the requirements of the laws of the United States and Canada.

The growth of mold on cheese surfaces, forms certain products which neutralize the cheese acid and soften or liquefy the interior.

Molded cheese ripen from the outside inwards.

Three minutes' stirring is usually sufficient to thoroughly mix rennet with milk.

Pasteurization of milk eliminates undesirable fermentations and disease-producing bacteria from fancy cheese and their by-products.

A clean factory, properly equipped, with a good water supply and system of sewage disposal, is a large factor in determining the quality of cheese.

The details of fancy cheesemaking are learned only by actual practice and close observation of the many changes which occur in the manufacturing and ripening processes.